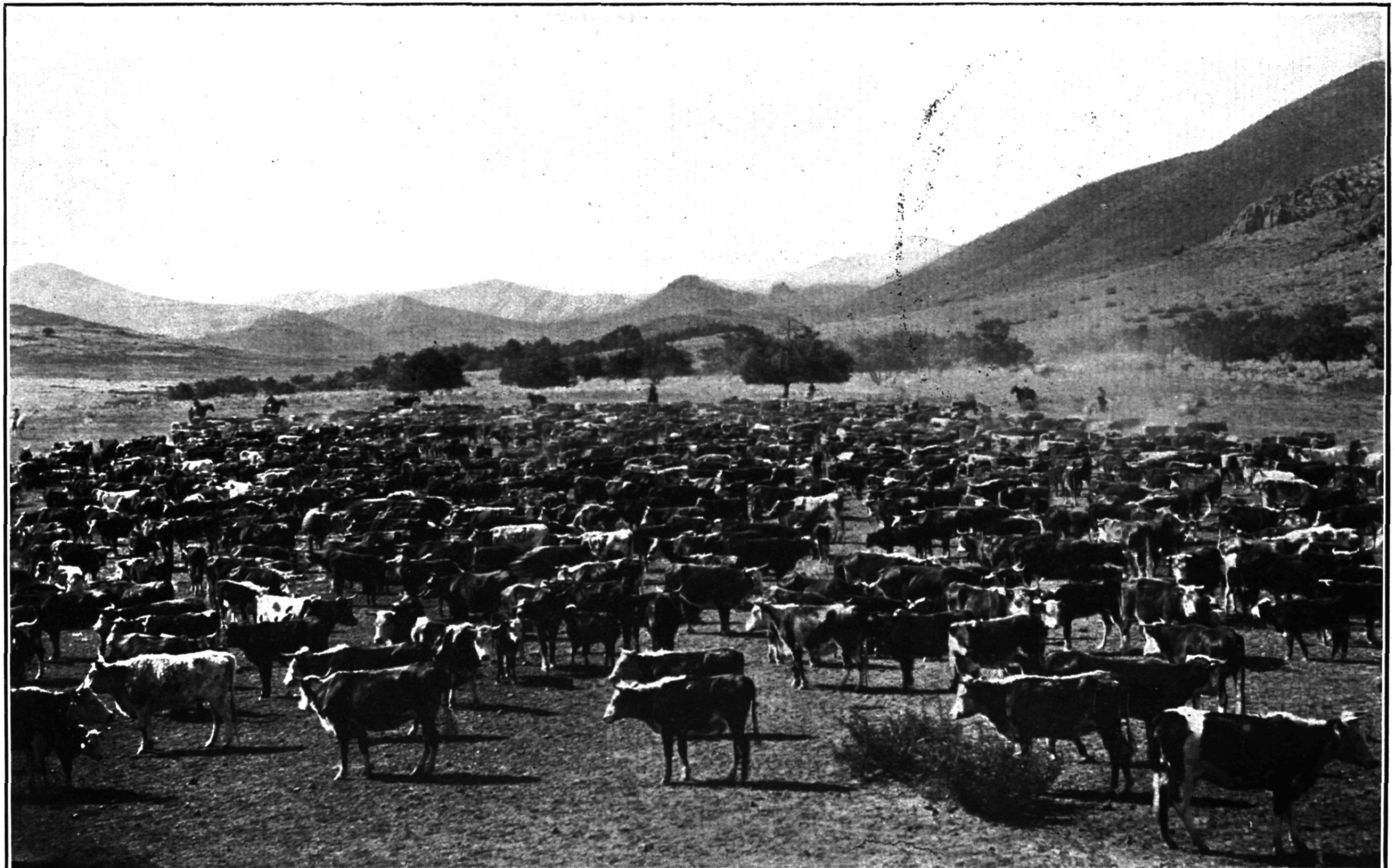

A ROUND-UP ON THE SIERRA BONITA RANCH, WILLCOX, ARIZ.

Photograph furnished by H. C. Hooker.

U. S. DEPARTMENT OF AGRICULTURE.

TWENTY-FIRST ANNUAL REPORT

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR

THE YEAR 1904.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1905.

[PUBLIC—No. 15.]

AN ACT providing for the public printing and binding and the disposition of public documents.

SEC. 73. Extra copies of documents and reports shall be printed promptly when the same shall be ready for publication, and shall be bound in paper or cloth, as directed by the Joint Committee on Printing, and shall be the number following in addition to the usual number.

Of the report of the Bureau of Animal Industry, 30,000 copies, of which 7,000 shall be for the Senate, 14,000 for the House, and 9,000 for distribution by the Agricultural Department.

Approved, January 12, 1895.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., May 22, 1905.

SIR: I have the honor to submit herewith the Twenty-first Annual Report of the Bureau of Animal Industry, prepared in accordance with the organic act creating the Bureau, and recommend that it be forwarded to the Public Printer for printing as provided by section 73 of the act of January 12, 1895.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary.

ORGANIZATION OF THE BUREAU OF ANIMAL INDUSTRY

[Revised to June 30, 1905.]

Chief: D. E. SALMON, D. V. M.

Assistant Chief: A. D. MELVIN, D. V. S.

Chief Clerk: E. B. JONES, LL. M., M. D.

Dairy Division: ED. H. WEBSTER, M. S., chief; CLARENCE B. LANE, B. S., assistant chief.

Inspection Division: A. M. FARRINGTON, B. S., D. V. M., chief.

Quarantine Division: RICHARD W. HICKMAN, Ph. G., V. M. D., chief.

Editor: GEORGE FAYETTE THOMPSON, M. S.

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Librarian: BEATRICE C. OBERLY.

LABORATORIES.

Biochemic Division: MARION DORSET, M. D., chief.

Pathological Division: JOHN R. MOHLER, A. M., V. M. D., chief.

Zoological Division: BRAYTON H. RANSOM, B. Sc., A. M., acting zoologist.

EXPERIMENT STATION.

Superintendent, E. C. SCHROEDER, M. D. V.; expert assistant, W. E. COTTON.

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REPORT OF THE CHIEF OF THE BUREAU.[a]

CONTROL OF CONTAGIOUS DISEASES.

SCAB OF SHEEP, CATTLE, AND HORSES.

It became evident last year that the means which the Bureau had employed up to that time to stamp out sheep scab were not proving as effectual as desired. This condition was due to various drawbacks. During the year just closed the methods of work were not changed in essential particulars, but the force of inspectors was increased, and wherever possible their work was concentrated until the scab was cleaned up from that point.

Last year the legislature of Wyoming, realizing that the sheep industry of that State could not prosper until the scab was eradicated, enacted a law providing for the cooperation of the board of sheep commissioners with this Bureau. Each of the inspectors of the Bureau in Wyoming received the additional appointment of inspector for the State. The result is stated by the board of sheep commissioners as follows:

> All sheep in the scab-infected counties were treated, and early in the spring of the present year the effects of the general dipping in 1903 were apparent, fully 75 per cent of the bands treated for the disease having been cleaned up. This season it was decided to continue the dipping, and we are pleased to note that the sheep men of the State, with few exceptions, are complying with the orders of the board.
>
> Last fall the counties of Albany, Laramie, Converse, and Weston were declared clean, and shipments went forth from those counties unrestricted. This year it is believed other counties will be declared clean, and in a short time Wyoming will be stricken from the list of scab-infested States.

It can be stated, some months since the above was written, that the final work will soon be done in Wyoming, and the Bureau's force of inspectors will be employed elsewhere.

The total number of inspections of sheep for scabies during the fiscal year was 40,967,961; the total number of dippings was 9,578,476, of which 1,957,278 were redippings. The number of cars cleaned and

[a] The report of the Chief of the Bureau is for the fiscal year 1903–04.

disinfected under the supervision of employees of the Bureau on account of this disease was 2,732.

The total number of inspections of cattle for scabies during the fiscal year was 1,124,321; the total number of dippings was 157,757, of which 59,788 were redippings. The number of cars cleaned and disinfected on account of this disease, under the supervision of employees of the Bureau, was 532.

The number of horses inspected from January 1 to June 30, 1904, was 752, of which 453 were found to be scabby; 138 infected were dipped in lime and sulphur. Three cars which had contained scabby horses were cleaned and disinfected.

VENEREAL DISEASE OF HORSES.

Work for stamping out a venereal disease of horses, the so-called maladie du coït, has been carried on since its inauguration under the immediate supervision of the Quarantine Division. In reporting upon it for the previous fiscal year some of the obstacles to the ready eradication of the disease were referred to. Among these obstacles have been the wild state of most of the country over which the disease has spread, the unbroken condition of the animals, and the lack of cooperation and aid on the part of owners throughout the worst infected sections, these being in and adjacent to the Indian reservations of South Dakota. Nevertheless, owing to the vigorous manner in which the work was prosecuted and the success then already attained, the hope was expressed that this disease might at a not very remote period be entirely stamped out. It is gratifying to be able to state that the hope then expressed has been so far realized that in the great annual round-up which lasted this year from June 1 to 28, inclusive, not a single diseased animal nor suspect was found.

During the year 76 animals were slaughtered because of showing evidences of the disease—4 stallions and 72 mares. In addition, 1,103 stallions which were running at large were castrated, and 302 stallions to be used for breeding purposes were tagged for identification. The total number of animals inspected was 11,604. The average indemnity paid by the Department for the 76 animals slaughtered because of being diseased was $21.21; the total amount was $1,612.

At the close of the year the services of laborers, who had been regularly employed in riding the range for the purpose of locating diseased animals, in performing castrations, and in doing other necessary work under the direction of the inspector in charge, were dispensed with; and under date of June 28, 1904, the Secretary of Agriculture issued an order, known as Bureau of Animal Industry Order No. 126, the subject-matter of which was regulations to prevent the spread of maladie du coït of horses. The provisions of this order,

so far as they related to the work in the Indian reservations, were previously concurred in by the Secretary of the Interior.

Investigation regarding the nature and cause of this venereal disease has been continued during the past year. Additional opportunity for its study was afforded by an outbreak in eastern Iowa similar to those in Nebraska and South Dakota, and from which point an affected stallion and mare were brought from Iowa to the experiment station of this Bureau for further examination. In order to make a comparative study of this disease as it occurs in the United States, and of maladie du coït, or dourine, as it occurs in France, arrangements were made through the courtesy of the late Professor Nocard for an official of this Bureau to make a study of dourine and its trypanosoma at the National Veterinary School at Alfort, France. This work was assigned to Dr. John R. Mohler, chief of the Pathological Division. Every opportunity was afforded him for the study of material at this school, and through the kindness of Doctor Nocard's assistants, Doctor Vallée and Doctor Carré, a dog was inoculated with the protozoan *Trypanosoma equiperdum*, from a horse affected with dourine, and brought to this country for the purpose of making a more detailed study of this parasite and the disease it engenders in horses.

MEAT INSPECTION.

During the fiscal year 1904 the inspection of cattle, sheep, calves, and hogs, and their products was conducted at 152 establishments, located in 51 cities. Inspection was inaugurated at 5 establishments, 3 of which were in cities where it was already in operation in other establishments, and 2 in other places. Inspection was discontinued at 12 establishments in 8 cities where it had been in operation the preceding year. The inspection of horses for slaughter ceased during the year 1903 and was not resumed in 1904.

The following summary shows the number of establishments and the number of cities at which inspection was conducted during each fiscal year since 1891:

Establishments and cities where meat inspection was conducted, 1891 to 1904.

Fiscal year.	Number of establishments.	Number of cities.	Fiscal year.	Number of establishments.	Number of cities.
1891	9	6	1898	135	35
1892	23	12	1899	139	42
1893	37	16	1900	149	46
1894	46	17	1901	157	52
1895	55	19	1902	155	50
1896	102	26	1903	156	50
1897	128	33	1904	152	51

The number of inspections of live animals for slaughter and the number rejected on such examination are shown in the following table:

Antemortem inspections for the fiscal year 1904.

Kind of animal.	For official abattoirs in cities where inspections were made.	For abattoirs in other cities and miscellaneous buyers.	Total inspections.	Rejected (subject to result of postmortem inspection).	
				At abattoirs.	In stock yards.
Cattle	6,490,144	6,109,687	12,599,831	757	42,263
Sheep	8,106,716	6,526,413	14,633,129	1,230	12,442
Calves	703,507	440,455	1,143,962	500	6,555
Hogs	24,722,894	11,513,567	36,236,461	3,807	59,519
Total	40,023,261	24,590,122	64,613,383	6,294	120,779

The preceding statement, when compared with the similar statement for 1903, shows an increase of more than 8 per cent in the total number of animals inspected for official abattoirs. This increase applies to all classes of animals except sheep, the number of which decreased about 3½ per cent, while the number of hogs inspected antemortem for official abattoirs increased about 14 per cent, the number in 1903 having been 21,707,381, as against 24,722,894 in 1904.

Following is shown the number of postmortem inspections and the number of carcasses and parts condemned (exclusive of hog carcasses condemned for trichinæ):

Postmortem inspections for the fiscal year 1904.

Kind of animal.	Number of inspections.			Number of carcasses condemned.			
	For official abattoirs.	On animals rejected in stock yards.	Total.	For official abattoirs.	Animals rejected in stock yards.	Total.	Parts of carcasses condemned.
Cattle	6,350,011	33,069	6,383,080	12,354	3,791	16,145	5,307
Sheep	8,261,051	8,082	8,269,133	7,151	1,263	8,414	341
Calves	764,590	3,337	767,927	1,207	922	2,129	114
Hogs	24,128,462	41,768	24,170,230	57,516	4,971	62,487	126,840
Total	39,504,114	86,256	39,590,370	78,228	10,947	89,175	132,602

Here, as in the antemortem inspections, the increase over 1903 is general, except as to sheep, being, however, principally in hogs, the number increasing from 21,827,047 in 1903 to 24,170,230 in 1904.

In addition to the number of carcasses condemned for various causes on the regular postmortem inspection and for trichinæ on the microscopic inspection, the numbers shown below were tanked for other reasons, as designated in the statement:

Manner of death.	Cattle.	Sheep.	Calves.	Hogs.	Total.
Died in yards	727	888	106	1,152	2,873
Killed in yards	1,682	1,064	1,285	13,248	17,279
Died in abattoirs	543	1,978	279	14,663	17,463
Total	2,952	3,930	1,670	29,063	37,615

The following table shows in detail the various diseases and conditions for which carcasses and parts were condemned and tanked during the year, and also includes animals found dead and those killed by city inspectors:

Causes of condemnation of carcasses and parts of carcasses, fiscal year 1904.

Cause of condemnation.	Cattle.		Sheep.		Calves.		Hogs.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Actinomycosis	1,130	2,379			16		55	46
Tuberculosis	10,173	703	11		22		34,656	118,820
Caseous lymphadenitis			1,593	66				
Cholera and swine plague							17,089	
Texas fever	71				58			
Echinococcus			1				3	8
Measles							10	
Scabies			18				82	
Eczema							9	
Erysipelas							6	
Cancer	68		7		1		15	
Tumor	12	2	4			1	538	290
Abscess	71	709	83	17	10	15	740	853
Pneumonia	201		362	1	26		1,137	
Pleurisy	3		19	11	4		115	12
Carditis			2					
Enteritis	32		132		18		271	
Peritonitis	222		88		38		551	
Metritis	25		16				175	
Nephritis	11		45		5		52	
Uremia	4		31		8		21	
Mammitis			1					59
Septicemia	255		175		48		677	
Pyemia	392		200		49		2,594	
Gangrene	35		10	4	8	16	31	
Anemia, emaciation, marasmus	1,870		3,833		356		611	
Ascites	13		58		1		45	
Jaundice	8		647		15		926	
Extreme temperature, various causes			42		1		1,550	
Pregnancy	90		63				171	
Recent parturition	66		13				42	
Hernia			4				9	
Downers, bruised, injured, etc	1,381	1,514	905	157	176	82	306	6,752
Dead from various causes	1,270		2,866		385		15,815	
Too young					1,258			

Causes of condemnation of carcasses and parts of carcasses, etc.—Continued.

Cause of condemnation.	Cattle.		Sheep.		Calves.		Hogs.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Killed by city inspectors	1,682		1,064		1,285		13,248	
Arthritis			1		4			
Tapeworm			1					
Pulmonary apoplexy			42		3			
Improper bleeding			1					
Flukes, hydatids, etc			1	85				
Distoma			2					
Edema			2		1			
Melanosis			1		3			
Asphyxia	12							
Total	19,097	5,307	12,344	341	3,799	114	91,550	126,840

The following comparative statement of postmortem inspections for official abattoirs from 1891 to 1904 shows that this work the past year was greater than in any previous year in the history of the Bureau.

Comparative statement of animals inspected at slaughter for abattoirs having inspection, fiscal years 1891 to 1904.

Fiscal year.	Cattle.	Calves.	Sheep.	Hogs.	Horses.	Total.
1891	83,889					83,889
1892	3,167,009	59,089	583,361			3,809,459
1893	3,922,079	92,947	870,512			4,885,538
1894	3,861,594	96,331	1,020,764	7,648,146		12,626,835
1895	3,704,042	116,093	1,428,601	13,616,539		18,865,275
1896	3,985,484	256,905	4,629,796	14,250,191		23,122,376
1897	4,242,216	273,124	5,209,161	16,808,771		26,533,272
1898	4,418,738	244,330	5,496,904	20,893,199		31,053,171
1899	4,382,020	246,184	5,603,096	23,836,943	3,332	34,071,575
1900	4,841,166	315,693	6,119,886	23,336,884	5,559	34,619,188
1901	5,219,149	413,830	6,639,212	24,642,753	1,992	36,916,936
1902	5,559,969	555,836	7,434,878	25,277,107	1,649	38,829,439
1903	6,134,410	668,855	8,585,960	21,793,738	344	37,183,307
1904	6,350,011	764,590	8,261,051	24,128,462		39,504,114

The meat-inspection tag or label was placed upon 22,943,067 quarters and 120,404 pieces of beef, 8,230,528 carcasses of sheep, 765,301 carcasses of calves, 1,122,193 carcasses of hogs, and 726,779 sacks of pork.

Following is shown the number of meat-inspection stamps that were affixed to packages of meat and meat products that had received the regular postmortem inspection:

Meat-inspection stamps.

Kind of meat.	Packages stamped (white stamps).
Beef	7,487,762
Mutton	42,596
Veal	165
Pork	15,524,234
Total	23,054,757

The number of cars sealed, containing inspected meat and meat products for shipment to official abattoirs and other places, was 80,551.

INSPECTION OF EXPORT MEATS.

There were 37,151 certificates of ordinary inspection issued to cover meat and meat products for export, as follows: 1,530,474 quarters, 14,544 pieces, 3 carcasses, and 1,479,833 packages of beef, weighing 419,058,781 pounds; 2,131 carcasses and 19,975 packages of mutton, weighing 712,089 pounds; 42,765 carcasses and 515,304 packages of pork, weighing 154,442,440 pounds; a grand total of 574,213,314 pounds.

Compared with the figures for 1903 this shows an increase in beef exports of 47,138,044 pounds, a decrease in mutton exports of 2,016,924 pounds, and an increase in pork exports of 21,319,830 pounds, being a net increase of 66,440,950 pounds.

The comparatively large decrease in the exports of mutton is explained by the fact that during a few previous years, on account of severe drought in Australia and New Zealand, the shipments of mutton from those countries to Europe were greatly reduced, so that there was an unusual demand for mutton from this country. The conditions last year having become normal, the trade in this class of product has decreased to its normal proportions.

Following is a comparative statement of beef, mutton, and pork exported under certificates of ordinary inspection during the past seven years:

Comparative statement showing quantities of meat for export under certificates of ordinary inspection, 1898 to 1904.

Fiscal year.	Beef.	Mutton.	Pork.
	Pounds.	*Pounds.*	*Pounds.*
1898	339,650,091	324,996	244,956,482
1899	360,843,856	525,705	278,696,435
1900	438,138,233	680,897	272,050,663
1901	452,830,373	894,648	231,144,938
1902	416,990,762	1,145,248	188,360,011
1903	371,920,737	2,729,013	133,122,610
1904	419,058,781	712,089	154,442,440

The cost of the work of ordinary inspection (interstate trade as well as export) for the year was $781,590.95.

MICROSCOPIC INSPECTION OF PORK.

The total number of carcasses examined for trichinæ was 315,045, classified as follows: Class A (free from all appearances of trichinæ), 307,621, being 97.64 per cent; Class B (containing trichinæ-like bodies or distintegrating trichinæ), 4,773, being 1.52 per cent; Class C (containing live trichinæ), 2,651, being 0.84 per cent.

The number of certificates issued for microscopically inspected pork was 1,576; the number of packages stamped for export was 30,734, weighing 9,020,521 pounds, being a decrease from the previous year of 10,087,820 pounds. This very large decrease is due to the falling off of our trade with Germany, the latter being our chief customer among the countries requiring microscopic inspection. Our shipments to Germany fell, in approximate figures, from 15,000,000 pounds in 1903 to 5,780,000 pounds in 1904.

The number of trichinous carcasses disposed of was 2,643; these weighed 612,912 pounds; 38.5 per cent of this amount was tanked, and 61.5 per cent was made into cooked meat products.

Following is a comparative statement of the quantity of pork exported to countries requiring certificates of microscopic inspection, 1892 to 1904:

Exports of pork inspected with microscope.

Fiscal year.	Weight.	Fiscal year.	Weight.
	Pounds.		*Pounds.*
1892	22,025,698	1899	108,858,149
1893	8,059,758	1900	55,809,626
1894	18,845,119	1901	35,942,404
1895	39,355,230	1902	33,681,2[illegible]9
1896	21,497,321	1903	19,108,341
1897	42,570,572	1904	9,020,521
1898	120,110,356		

The cost of microscopic inspection for the year was $53,934.01, being an average of 17.1 cents for each carcass examined and 0.6 cent for each pound exported.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

The number of clearances of vessels carrying live stock was 774. The number of certificates of inspection issued for American cattle exported to Europe was 1,419.

Following is a statement of the number of American and Canadian

animals inspected for export, the number exported, etc. As compared with similar figures for 1903 this statement shows an increase of 43.7 per cent in the number of American cattle exported, and an increase of 116.5 per cent in the number of American sheep exported; while the number of American horses exported in 1904 is shown to be nearly one-third less than the number exported in 1903.

Inspections, etc., of American and Canadian animals for export, fiscal year 1904.

Kind of animal.	American.				Canadian.		
	Number of inspections.	Number rejected.	Number tagged.	Number exported.	Number inspected.	Number rejected.	Number exported.
Cattle	764,126	3,157	424,689	[a] 414,320	26,370	8	26,362
Sheep	474,754	460	....	[b] 241,294	60,096	47	60,049
Horses	3,258	2	2,724	2,649	35	....	35

[a] 47,653 via Canada. [b] 12,699 via Canada.

All the animals included in the above statement were exported to Great Britain, except 18,439 cattle, 11,135 sheep, and 111 horses to Belgium; 399 cattle, 137 sheep, and 1 horse to South Africa; 198 horses to Germany, and 4 horses to Italy.

In addition to the exports mentioned above there were also exported to other countries 1,749 cattle, 2,335 sheep, 10 horses, 20 swine, and 1 jackass, making a total of 4,115, destined as follows: 1,520 cattle, 2,036 sheep, and 10 horses to Bermuda; 298 sheep to Barbados; 203 cattle and 1 sheep to Brazil; 22 cattle, 20 swine, and 1 jackass to Argentina; 4 cattle to Mexico.

The number of American and Canadian animals landed alive and inspected by representatives of this Bureau at London, Liverpool, and Glasgow is shown in the statement below. The apparent discrepancy between this statement and the preceding statement showing the number exported is accounted for by the number of animals exported to countries other than Great Britain, and to such British ports as Hull, Bristol, and Manchester, where the Bureau has no representative:

Statement showing number of animals inspected at time of landing in London, Liverpool, and Glasgow, and loss in transit, fiscal year 1904.

From—	Cattle.			Sheep.			Horses.		
	Landed.	Lost.	Per cent of loss.	Landed.	Lost.	Per cent of loss.	Landed.	Lost.	Per cent of loss.
United States	360,990	610	0.17	212,299	2,011	0.94	2,353	13	0.55
Canada	19,375	39	.20	57,767	1,555	2.62	35	......	....
Total	380,365	649	.17	270,066	3,566	1.30	2,388	13	.54

INSPECTION OF IMPORTED ANIMALS.

Animals were inspected for importation from Mexico as shown below:

Statement showing importation of Mexican animals, fiscal year 1904.

Port of entry.	Cattle.	Sheep.	Swine.	Goats.	Horses.	Mules.	Asses.	Burros.	Dromedary.
Eagle Pass, Tex					6				
El Paso, Tex	7,603				5	15			
Nogales, Ariz	3,645		15	13	140	65	7		
San Diego, Cal	840	700	66		154	15	2	3	
Laredo, Tex		1			9		1		1
Total	12,088	701	81	13	314	95	10	3	1

Inspections were also made at El Paso of animals imported from Mexico, in bond, as follows: 1,201 sheep in transit to Mexico; 9,461 cattle, 103 horses, and 7 mules in transit to Canada.

QUARANTINE AT PORTS OF ENTRY.

Heretofore there have been frequent arrivals at seaboard ports of animals of the ruminant class, and occasionally of swine, destined for menageries and parks, for which no permit had been obtained previous to shipment, although such a permit is required by paragraph 9 of Order No. 109 of this Bureau, being regulations concerning the inspection and quarantine of horses, neat cattle, sheep, and other ruminants, and swine imported into the United States. Recent instructions have been given to United States consuls, however, by the Secretary of State, which have removed all misunderstanding as to the meaning of the term "ruminants." All hay-eating animals are not ruminants, but only such as regurgitate a portion of their food for remastication, or, as it is commonly stated, "chew the cud." Asses, mules, zebras, and zebrules are admitted under the provisions of the regulations governing the importation of horses, and ruminants other than cattle and sheep, as provided for sheep.

IMPORTS OF PUREBRED DOMESTIC ANIMALS, ETC.

The importation of purebred cattle, sheep, and hogs during the year has been extremely light. There have been received at New York, the chief port of entry for animals for breeding purposes, in the classes named, and quarantined at the animal quarantine station for that port, located at Athenia, N. J., 266 cattle, 128 sheep, and 123 hogs. At the other ports on the Atlantic seaboard designated as ports of entry for import animals requiring inspection and quarantine, animals were entered as follows: At Boston, and quarantined at

the animal quarantine station at Littleton, Mass., 17 cattle, 15 sheep, and 3 hogs; at Baltimore, and quarantined at the quarantine station at Halethorp, Md., 48 cattle, 2 sheep. While the importations of cattle and sheep, as well as hogs, have been light, there has been an unusual number of entries of other ruminants, such as are imported by owners of menageries and zoological collections, all of which are subject to inspection and quarantine.

IMPORTATIONS NOT SUBJECT TO QUARANTINE.

There have been imported through ports on the seacoast animals not subject to quarantine as follows:

Number of animals imported not subject to quarantine.

Country.	Horses.	Ponies.	Mules.	Asses.
Great Britain	1,523	3	1	2
Germany	204			6
Belgium	651			10
Italy	6			16
Egypt				15
Mexico	3	8	1	
Porto Rico	4	1		
Costa Rica	2			
Argentina	1			
Bermuda	10	1		1
Cuba	5			
Canada	16			
Iceland		2		
Total	2,425	15	2	50

QUARANTINE AGAINST HOLLAND WITHDRAWN.

It having been shown that Netherlands was free from contagious foot-and-mouth disease and other contagious and infectious diseases of animals for the existence of which this Department prohibited their importation, the embargo was withdrawn from Holland cattle by the order of the Secretary under date of February 24, 1904, in Amendment No. 2 to Order No. 109 of the Bureau of Animal Industry.

FOOT-ROT OF SHEEP.

Considerable difficulty was experienced in securing suitable material for the continuation of investigations as to the cause of foot-rot of sheep; but an outbreak among a flock in West Virginia and the arrival at the Buffalo stock yards of a flock from the West, 75 per cent of which were lame, furnished the desired subjects. From these sheep the constant presence of the *Bacillus necrophorus* in all of the affected feet was fully established.

This microorganism has been previously recognized as the causative agent in the development of ulcerous, necrotic lesions in several diseases of domestic animals, and tests made with it upon the feet of healthy sheep have shown that it is capable, when applied in pure culture, of producing lesions which closely resemble those found in cases of foot-rot resulting from natural infection. The tests have also shown that its use, in association with the other microorganisms present in affected feet, will produce the disease in its typical form; while the use of these same associate bacteria without the presence of the *B. necrophorus* will produce no lesion upon the healthy foot. Basing deductions upon the above facts, it seems reasonable to conclude that the *B. necrophorus* must be present before a true case of foot-rot can develop in sheep. A bulletin, emanating from the Pathological Division, treating of the nature, cause, and treatment of this disease, has recently been issued.

PRESENCE OF GID OF SHEEP IN THE UNITED STATES.

During a recent trip to Montana by the acting zoologist of this Bureau, specimens of a bladderworm were obtained from the brain of a sheep which seems to be identical with the gid bladderworm, *Cœnurus cerebralis*, of Europe, and it produced similar symptoms. This bladderworm, the adult stage of which (*Tænia cœnurus*) lives in the intestines of dogs, is very common in the Old World, and is one of the most dangerous and destructive parasites with which sheep may be infected. A few years ago it was said that 1,000,000 sheep die from it annually in France, and the losses in Germany have been put at 15 per 1,000 in the first year of life, 5 in the second year, 2 in the third year, and 1 in the fourth. In England, although the parasite seems to be less common than formerly, the mortality at times in some flocks is as high as 35 per cent. The only practicable treatment lies in prevention, which consists principally in keeping the dogs free from tapeworms by frequent dosing with vermifuges and by preventing them from eating the uncooked brain or spinal cord of infected sheep. Until the present time no well-established cases have been reported from the United States, which is rather remarkable in the face of numerous importations from Europe both of sheep and dogs, some of which must certainly have been infected. Although the conditions existing in this country are perhaps unfavorable to the parasite, so that it has been unable to gain a foothold, and although so far it may have caused little damage, its presence here is, nevertheless, a constant menace; and there is danger that, if unchecked, it will in the future become as serious a pest in the United States as it is in Europe. It is therefore important that a careful

investigation of this parasite be made in this country, and that thorough measures be taken to prevent its dissemination.

TUBERCULOSIS.

The work on the subject of tuberculosis is being conducted in two divisions of the Bureau. In the Pathological Division the comparative study of tubercle bacilli which were obtained from a number of varied sources has been in constant progress during the entire year, having been continued under the same conditions as those inaugurated at the commencement of this investigation.

Additional cultures have been obtained from a tuberculous parrot and from a raccoon, the disease in each case being the result of natural infection. In addition to these, tuberculous specimens have been received which were taken from a snake, a monkey, a Philippine deer, and from a number of hogs and cattle. While bacilli from none of these latter have been grown artificially, the specimens have been used to demonstrate the form of bacillus present in each case, its manner of grouping, and the character of lesion produced by it in its natural host. Experiments have been made with two cultures of slight virulence for the purpose of determining the conditions under which an added degree of virulence may be given them. These investigations are about concluded, and the results are now in course of preparation for publication.

In the Biochemic Division the experiments concerning the intercommunicability of human and bovine tuberculosis have been completed, and Bulletin No. 52, in three parts, dealing with this subject, has been published. Parts II and III of this bulletin have only recently been published, considerable delay in this work having been caused by the death of Dr. E. A. de Schweinitz, the former chief of this division.

The results of our experiments concerning the infectiousness of human tuberculosis for cattle, and also those experiments concerning the comparative virulence of human and bovine tubercle bacilli for other animals, may be briefly summarized as follows: Nine fresh cultures of tuberculosis, from as many different cases of that disease in human beings, were isolated; four of these cultures were isolated from children affected with generalized tuberculosis. None of the cultures isolated from adults exhibited a degree of pathogenic power for cattle which was in any way comparable to that usually manifested by the bovine tubercle bacillus. Of the four cultures isolated from children, however, two produced a generalized tuberculosis in calves after subcutaneous inoculation, and the lesions produced were quite as severe as those produced by a fresh culture of the bovine

tubercle bacillus which was isolated from a case of natural tuberculosis in a cow. A third one of the cultures from children, while distinctly less virulent than the two just mentioned, was able to bring about a localized infection, which spread from the point of inoculation to several of the neighboring lymph glands. This third culture should be considered pathogenic for cattle, though in a distinctly less degree than the ordinary bovine bacillus.

The inoculation experiments with hogs and rabbits gave results quite similar to those obtained with cattle, two of the human cultures (from children) being indistinguishable from the bovine bacillus in respect of their action upon these animals. The inoculation of guinea pigs brought out no distinctions that were worthy of note between the various cultures.

These experiments, it is believed, go to show conclusively that it is an error to conclude that cattle can not be infected with human tuberculosis; and they also indicate that the children from which the two most virulent cultures were obtained were either infected from bovine sources or that certain forms of human tubercle bacilli are indistinguishable from bovine bacilli, both with regard to their virulence and cultural characteristics; furthermore, they agree in general with those of the great majority of investigators who have studied this subject during the past two years. These experiments not only justify but show the desirability of a rigid enforcement of public regulations looking to the control and the eradication of tuberculosis in cattle.

At the experiment station of the Bureau certain features of investigations in tuberculosis are carried on. Cow No. 218, to which reference was made in my last report, is still there. This cow received an injection of human tubercle culture into one quarter of the udder over two years ago. The injection was made without causing any injury to the tissues other than such as would result from the presence of the infecting germs. The material secreted by the injected quarter of the udder continues to show the presence of the tubercle germs, and is infectious for guinea pigs on subcutaneous injection. The cow has lately dropped a calf, and it will be interesting to observe whether the latter contracts the disease.

THE DISTRIBUTION OF TUBERCULIN.

During the past year there were prepared in the Biochemic Division and sent to the various States and Territories and foreign countries enumerated below about 74,000 doses of tuberculin. It will be noted that there was an increase for the year of more than 50 per cent in the amount of tuberculin sent out over that for the fiscal year ended June 30, 1903, when the total amount distributed was 47,358 doses.

Doses of tuberculin distributed, fiscal year 1903–1904.

	Doses.		Doses.
California	152	New Jersey	1, 960
Colorado	250	New Mexico	174
Connecticut	54	New York	993
District of Columbia	239	North Carolina	258
England [a]	600	North Dakota	135
Illinois	20	Ohio	204
Indiana	24	Oklahoma	102
Iowa	450	Oregon	130
Kansas	306	Porto Rico	60
Maine	123	Utah	92
Maryland	344	Vermont	12, 256
Massachusetts	17, 016	Virginia	12
Michigan	415	Washington	3, 926
Minnesota	19, 294	Wisconsin	3, 010
Missouri	112		
Montana	11, 000	Total	73, 912
Nebraska	201		

[a] For testing cattle offered for importation into the United States.

THE TUBERCULIN TEST IN ENGLAND.

The work of the official veterinarian stationed at London, England, is in accordance with Order No. 79 of this Bureau, dated November 10, 1900, which provides for the testing with tuberculin by the inspector of this Bureau of all cattle over six months old which are to be imported into the United States for breeding purposes. During the year this work has diminished because of fewer importations of pure-bred animals. The inspector has tested of the different breeds in various parts of Great Britain and Holland as follows;

Results of tuberculin test in England and Holland of cattle for importation.

Breed.	Passed.	Rejected.	Breed.	Passed.	Rejected.
Shorthorn	11	3	Galloway	78	0
Aberdeen Angus	7	2	Holstein [a]	90	29
Ayrshire	4	3	Total	202	37
Guernsey	11	0			
Hereford	1	0			

[a] Tested in Holland.

BLACKLEG INVESTIGATIONS.

The routine work in the Pathological Division of preparing and distributing blackleg vaccine has been continued as heretofore. The number of doses sent out has fallen off somewhat, but the number of persons supplied is slightly greater than for the previous year. It is interesting to note that during the fiscal year 1903 over 1,000,000

doses of vaccine have been used and reported upon by over 10,000 persons with highly satisfactory results. The number of mistakes made may be accounted for by the number of persons making use of vaccine for the first time and their consequent unfamiliarity with its application. The appended tables give the quantity of blackleg vaccine distributed during the past year and the immunizing effects of the vaccine sent out during the previous year.

Doses of vaccine distributed during the fiscal year ended June 30, 1904.

	Doses.
July 1 to December 31, 1903:	
July	49,735
August	54,365
September	153,570
October	217,995
November	188,865
December	115,130
January 1 to June 30, 1904:	
January	84,290
February	71,630
March	147,600
April	138,055
May	71,175
June	44,440
Total	1,336,580

Results obtained from vaccine distributed during the fiscal year ended June 30, 1903.

State or Territory.	Number of reports.	Number of cattle vaccinated.	Deaths same season previous to vaccination.		Number died after vaccination.					
			Number.	Per cent.	Within 48 hours.	From 2 to 7 days after.	Within 1 year.	Cases due to mistakes.	Total number.	Per centage of deaths.
Arizona	5	624	25	4.01		1	4	1	6	0.96
Arkansas	14	917	46	5.01			3		3	.32
California	518	76,991	1,251	1.62	12	43	304		359	.46
Colorado	664	95,427	1,094	1.14	20	53	299	1	373	.39
Idaho	52	4,907	93	1.89		3	15		18	.36
Illinois	29	1,028	61	5.93	1	1	3	2	7	.68
Indiana	4	79	8	1.12						
Indian Territory	94	11,064	406	3.66	5	11	35		51	.46
Iowa	170	9,855	277	2.81		4	43	7	54	.54
Kansas	1,358	114,249	2,679	2.34	17	60	257	105	439	.38
Kentucky	40	1,189	130	6.88			7	1	8	.42
Michigan	6	166	12	7.22				1	1	.60
Minnesota	67	3,603	148	4.10			11	2	13	.36
Missouri	813	34,873	982	2.81		28	127	38	193	.55
Montana	412	48,207	794	1.64	3	20	84	25	132	.27
Nebraska	2,132	167,173	3,390	2.02	4	59	643	221	927	.55
Nevada	2	259	10	3.86						
New Hampshire	3	42	3	7.14						
New Mexico	43	8,764	68	.77		6	20	6	32	.36
New York	16	653	6	.91			4		4	.61

Results obtained from vaccine distributed during the fiscal year ended June 30, 1903—Continued.

State or Territory.	Number of reports.	Number of cattle vaccinated.	Deaths same season previous to vaccination.		Number died after vaccination.					
			Number.	Per cent.	Within 48 hours.	From 2 to 7 days after.	Within 1 year.	Cases due to mistakes.	Total number.	Percentage of deaths.
North Carolina	20	740	45	6.08		1	1		2	0.27
North Dakota	614	62,606	1,626	2.59	3	31	246	36	316	.50
Oklahoma	224	19,443	387	1.99		21	76	6	103	.52
Oregon	143	19,288	368	1.90		12	25	14	51	.26
South Dakota	613	53,285	1,299	2.43	8	41	269	50	368	.69
Tennessee	74	2,464	99	4.01	1	3	18		22	.89
Texas	1,115	205,020	3,328	1.62	20	178	1,207	126	1,531	.74
Utah	25	5,364	29	.54		5	4	15	24	.44
Vermont	4	75	2	2.66						
Virginia	361	12,224	442	3.61	1	12	48	1	62	.50
Washington	24	965	2	.20						
West Virginia	119	2,928	99	3.38	11	2	9	1	23	.78
Wisconsin	2	223	6	2.69						
Wyoming	308	53,361	485	.90	1	22	149	11	183	.34
Other States	8	1,073	25	2.30			7		7	.65
Total	10,096	1,019,829	19,795	1.93	107	617	3,918	670	5,312	.52

From the above table it will be seen that 670 cattle died as result of mistakes admitted by the stock owners, while 107 animals died of blackleg within forty-eight hours after the injection, thereby indicating that these latter animals were affected with the disease prior to vaccination. In determining the value of blackleg vaccine it seems proper to deduct these numbers from the total number of deaths following vaccination. After eliminating these deaths, which could not be attributed to any fault of the vaccine, the number of cases that died after vaccination is reduced to 4,535, or 0.44 per cent.

TEXAS FEVER.

An interesting condition relative to the persistence of the Texas fever organism in the blood of southern cattle after their removal from the so-called permanently infected territory was observed a second time this year at the experiment station. In the year 1901 a cow injected with blood from an old southern cow, No. 113, became affected with Texas fever. In the year 1902 two cows injected with blood from the same southern cow failed to become affected, while two other cows injected with blood from another southern cow, No. 1, suffered attacks of Texas fever. At that time cow No. 113 had been removed from the permanently infected Texas fever territory thirteen years, and cow No. 1 seven years. In the year 1903 there was no test of the blood of southern cattle. This year (1904) two cows were injected with blood from southern cow No. 214, and four cows

with blood from cow No. 113. The cows injected from No. 214 suffered with severe Texas fever, as a result of which one of them died. The four cows injected from No. 113 remained well. Two of the latter were subsequently injected with blood from No. 214, and one remained well, and the other became affected with Texas fever, thus showing conclusively that the absence of disease following the injection with blood from cow No. 113 was not due to immunity on the part of the animals injected. Cow No. 214, which unfortunately died this summer as the result of tuberculosis, was removed from the Texas fever territory in the year 1892; that is, thirteen years before the last injections were made. The infection in the blood of cow No. 113 persisted during twelve years, and was entirely absent in the thirteenth and fifteenth years after removal from all known sources of infection or reinfection. Cow No. 113 is now affected with generalized tuberculosis and will probably die in the course of the next few months.

In the Biochemic Division during the past year a large number of analyses of oils and various dips recommended for the destruction of the tick known as *Boophilus annulatus* have been made, and, in addition, experiments have been instituted to determine the effect of these various dips upon these ticks and the relation of the composition of the various oils to their effect upon the ticks. This work, however, has not yet been completed.

The operations of the Bureau, as related to the control of Texas fever during the quarantine season of 1903, included the inspection and proper yarding at packing centers of 46,505 carloads of cattle from below the quarantine line, the number of animals being 1,350,623; also, supervision of the cleaning and disinfection of 45,589 cars.

There were also inspected in the noninfected area of Texas 179,116 head of cattle, which were permitted to be moved North for purposes other than immediate slaughter.

NECROTIC STOMATITIS OF CALVES AND PIGS.

The investigations on the bacteriology and pathology of so-called calf diphtheria announced in the last report have been brought to a successful termination. There will soon be issued a bulletin upon the subject, in which, as a result of careful and exhaustive study of the lesions, the name "necrotic stomatitis of calves" will be adopted in preference to the misleading term "calf diphtheria."

In the course of these researches a few cases of "sore mouth" in pigs were studied with the result that the peculiarly beaded filament of *Bacillus necrophorus* was isolated, and a demonstration obtained of its pathogenic relation to what we have called "necrotic stomatitis of pigs." The great difficulty in isolating the organism from diseased

tissues and the peculiarity of its pleomorphism and anaerobic growth have conspired to make the work slow and at times tedious. The bulletin will not only describe the character, cause, and treatment of necrotic stomatitis, but will also prove the entire absence of any connection whatever between the diphtheria in human beings and so-called calf diphtheria.

HOG CHOLERA AND SWINE PLAGUE.

The experiments concerning hog cholera and swine plague have been continued by the investigations in the biochemic laboratory and at the experiment station. As noted in Circular No. 41, issued October 1, 1903, certain new and apparently important facts concerning the etiology of hog cholera have been discovered. Under these circumstances it has been thought advisable to investigate thoroughly the etiology of hog cholera, in order that we may proceed more intelligently in our efforts to discover a cure or preventive for this disease. Therefore, during the past six or eight months our chief efforts have been directed to a study of the causes of hog cholera and the manner in which it is communicated. The great importance of securing a vaccine for this disease, however, is being kept constantly in mind. Certain methods of producing immunity, the value of which has not yet been definitely determined, are indicated in Circular No. 43 of this Bureau, which was published in February, 1904. The experiments concerning the etiology of hog cholera have been beset with many difficulties and adverse circumstances, but progress is being made, and it is confidently hoped that during the fall of the present year we may be able to publish the results of our investigations.

GLANDERS.

In December, 1903, an official of the Pathological Division was sent to West Point, N. Y., to confirm, if correct, the diagnosis of a supposed outbreak of glanders among the army horses at the United States Military Academy. Clinical examination of the suspected cases and necropsies on five of these animals showed the presence of glanders, which diagnosis was further confirmed by laboratory inoculations. A full report was made to Col. Albert Mills, Superintendent of the Academy, embodying recommendations for the testing of the horses with mallein, the disinfection of the stables, the isolation of the affected animals, and such other measures as are essential for the suppression and eradication of the disease.

During the year there have been prepared in the Biochemic Division and distributed to various States and Territories 7,197 doses of mallein, which amount is approximately the same as reported for the previous year. The details of the distribution are as follows:

Distribution of mallein to States and Territories.

	Doses.		Doses.
Arizona	12	Montana	204
California	504	Nebraska	24
Colorado	54	North Dakota	608
District of Columbia	2, 174	Ohio	462
Illinois	672	Oklahoma	136
Iowa	60	Philippine Islands	54
Kansas	30	South Carolina	60
Maryland	2	Vermont	60
Michigan	48	Washington	36
Minnesota	1, 738		
Missouri	259	Total	7, 197

RABIES.

Investigations regarding the presence of rabies in the vicinity of Washington, D. C., have been continued during the year. Of the 38 suspected cases examined, positive results have been obtained with 19 dogs, 2 cows, and 1 hog, of which number 13 were from the District of Columbia, 1 from Maryland, 7 from Virginia, and 1 from South Carolina. The results of the inoculation of oblongata emulsion and histological examination of the plexiform ganglia, together with the number of persons and animals bitten, and the species and origin of the animal affected, are given in the following table:

Results of inoculation tests and microscopic examination for rabies.

Date.	Record No.	Kind of animal.	Received from—	Result of inoculations.	Diagnosis by histological examination.	Persons or animals bitten.
1903.						
July 3	306	Dog	District of Columbia	Positive	Positive	1 dog.
July 27	308	do	do	do	None made	
Aug. 18	311	Hog	Norfolk, Va	do	do	
Aug. 24	313	Dog	District of Columbia	do	do	
Sept. 21	315	do	do	do	Not typical	
Oct. 5	317	Cow	Frederick, Md	do	None made	
Oct. 29	319	Dog	District of Columbia	do	Positive	1 boy.
Oct. 29	320	do	do	None made	do	
Dec. 9	322	do	Norfolk, Va	Positive	do	1 girl.
Dec. 12	323	do	District of Columbia	do	do	
Dec. 31	324	do	Ridgeway, S. C	do	do	Dogs, chickens, and several persons.
1904.						
Jan. 27	325	Dog	Leesburg, Va	Positive	None made	
Feb. 6	326	Cow	do	do	do	
Mar. 16	327	Dog	District of Columbia	do	do	
Mar. 30	329	do	Rosslyn, Va	do	Positive	1 girl and several dogs.
Mar. 30	330	do	District of Columbia	do	None made	
Apr. 2	331	do	do	do	do	
Apr. 24	332	do	do	do	Positive	
Apr. 26	334	do	Norfolk, Va	do	do	2 persons.
May 4	336	do	District of Columbia	do	None made	
May 29	339	do	do	do	Not typical	1 dog.
June 11	341	do	Purcellville, Va	do	None made	

INFECTIOUS ENTERITIS OF PIGEONS.

Several reports have reached this Bureau during the past few months of a rapidly fatal disease among pigeons; and as the economic importance of it has been established, it is desired to institute a rigid investigation relative to the causative agent, the preventive and curative treatment, and the methods of dissemination.

Out of seven reported outbreaks 19 birds have been examined in the Pathological Division, which represent a total number of about 300 deaths, amounting to 25 per cent loss of those affected. An actively motile bacillus, belonging to the enteritidis group, has been isolated from the brain, heart, liver, spleen, and kidney of the dead birds; and when this organism has been tested on experimental animals, either by inoculation, feeding, or cohabitation, a similar disease is produced, from which the specific bacillus may be recovered. Thus far the organism has proved pathogenic for pigeons, rabbits, guinea pigs, and mice, and the resulting disease of these animals is characterized by marked intestinal inflammation, with fatty degeneration of the liver and punctiform areas of necrosis in the liver and spleen. Further experiments are now being conducted.

EXPERIMENTS IN POULTRY FEEDING.

During the past fiscal year the results of the preliminary experiments conducted by the Biochemic Division to determine the digestion coefficients of some of the more common grains for chickens have been published as Bulletin No. 56 of this Bureau. These experiments involved a great deal of labor, inasmuch as they constitute almost pioneer work in this line with chickens. The following provisional conclusions may be drawn from the work already completed:

(1) The crude protein and nitrogen-free extract are assimilated in much greater proportion with corn than with oats.

(2) The availability of the crude fat of corn is slightly greater than that of oats.

(3) The digestibility of the crude fat of wheat is conspicuously less than that of corn and oats.

(4) Chickens consume a much greater quantity of corn than oats.

(5) The nutritive superiority of corn over oats is indicated by an increase in body weight when corn is fed, while there is a tendency to the opposite direction when oats is the sole article of diet.

(6) The nutrients of corn are fed at a lower cost than those of oats and wheat. This conclusion is based upon the actual availability of the various nutrients of the grains.

The poultry experiments are being carried further and involve the feeding of mixed diets of corn, oats, and wheat. From these experi-

ments it is hoped that some data may be obtained which will be of practical use to poultry raisers.

INVESTIGATIONS OF THE PARASITES OF LIVE STOCK IN MONTANA.

An investigation of the parasites of live stock in the State of Montana was undertaken by the Zoological Division in May of the present year with the primary object of discovering a possible relation between the so-called loco disease of cattle, sheep, and horses and the presence of animal parasites. This investigation was confined entirely to Park County, where the disease has been prevalent for many years, entailing constant and serious loss among live stock, especially sheep. Many cases of the disease were seen among sheep, as high as 10 per cent of some flocks being affected. In the fall the percentage is higher and the symptoms more pronounced. Numerous autopsies were performed on diseased and on healthy sheep. One herd of cattle was seen in which two years ago 20 per cent were said to have been lost from the effects of loco. At the time they were seen, however, the animals were in good condition; only a few showed symptoms of the disease, and in so slight a form that it did not seem warrantable to sacrifice any for postmortem examination. Two "locoed" horses were seen, and one was killed and an autopsy performed. For the purpose of experiments on the life history of their parasites and for further study of the loco disease, a number of parasitized and "locoed" sheep were procured for shipment to the zoological laboratory at Washington.

Numerous parasites were collected from diseased and healthy sheep and from the locoed horse, some of them being species not yet described. A hasty biological examination was made of a number of small mountain ponds frequented by stock. Incidentally parasites were collected from prairie dogs, birds, fish, etc. A mite of an unknown species was obtained from a prairie dog badly affected with mange. The notes and material gathered during the trip have not been worked up and therefore no definite results can be reported at this time.

MISCELLANEOUS WORK IN RELATION TO DISEASES OF ANIMALS.

Much attention has also been given in the Pathological Division to various minor subjects, among which are the following: The study of an outbreak of forage poisoning among the horses at Charlotte, N. C., and at Arlington, Va., in which no macroscopic or microscopic lesions of leucoencephalitis could be found; the experimental study of the *Aspergillus fumigatus*, and the preparation of an article, entitled "Aspergillosis of birds," based on this investigation; the publication of a paper on milk fever, with a description of an instrument for the

application of the new air treatment; the preparation of an article regarding the pathological findings and inoculation experiments in a case of rabies in a woman; the monthly renewal of 89 stock cultures of different microorganisms which are maintained for exchange and comparison with those of other investigators; the preparation and installation of a pathological and bacteriological exhibit at the New England Exhibition of Arts and Crafts, Providence, R. I., and at the Johns Hopkins University, Baltimore, Md., on the occasion of the Maryland Tuberculosis Exhibition, and at the Louisiana Purchase Exposition, St. Louis, Mo.

In the Biochemic Division analyses were made of a large number of substances said to contain nicotine and which were submitted to the Bureau for its approval for use in the preparation of the nicotine dip for sheep scab. A large number of kretol dips were also examined chemically. A thorough chemical examination was made of a lot of ensilage supposed to be the cause of the death of a number of horses and mules on the Department farm at Arlington, without, however, the discovery of any substances which could be held responsible for the disease in the animals.

Numerous identifications have been made in the zoological laboratory of parasites sent to the Bureau by veterinarians, physicians, farmers, etc. The collection has been increased by exchange and collection. An exhibit of parasites was prepared for the Louisiana Purchase Exposition. A bulletin (No. 60) concerning the nematode parasites of the eyes of chickens and other birds has been prepared and is now in press. This bulletin contains also an article on two important tapeworms of chickens. Mr. Stevenson, of the zoological laboratory, has prepared a circular on a hitherto undescribed parasitic nematode which was the cause of the loss of nearly the entire flock of fancy pigeons in which it was discovered.

The work of publication of the "Index-Catalogue of Medical and Veterinary Zoology" has continued, and during the year the "D," "E," and "F" authors have been issued, while the "G" and "H" authors are now in press.

AUTOPSIES ON WILD ANIMALS.

Postmortem work for the National Zoological Park continues to play an important rôle in the routine work of the pathological laboratory. Reports were made on 55 such postmortem examinations. A bacteriological examination of the tissues of many of these animals was made in order to determine definitely the presence of infectious diseases. These investigations, while only fruitful in the demonstration of a few such diseases, were nevertheless carried out consistently in those cases which seemed to justify it.

THE EFFECT OF PRESERVATIVES UPON DIGESTIVE ENZYMES.

The experiments instituted to determine the effect of various preservatives upon the digestive enzymes and upon the digestibility of milk have been completed. These experiments were conducted in the Biochemic Division, and the results are given in detail in the annual report of this Bureau for 1903.

WORK IN THE INTEREST OF THE DAIRY.

INSPECTION OF RENOVATED BUTTER.

During the year a large part of the work of the Dairy Division has been the administrative service assigned to it in connection with the act of Congress, approved May 9, 1902, concerning the manufacture, interstate commerce, and export of renovated butter. This has been the second fiscal year of the operation of this law, and the inspection service has become fully organized and well regulated. The ten dairy inspectors have been appointed upon certification from the Civil Service Commission, based upon special examinations, and the corps has proved efficient and satisfactory.

The law mentioned is now operating without friction, but experience for two years in its administration has developed certain features of weakness and indicated amendments which are needed for its greater efficiency. This subject will be presented as a special report at an early date.

The Treasury Department has reported 73 different factories having been licensed and bonded during the year for the manufacture of renovated butter, as against 82 for the year before. These were located in 14 States and the District of Columbia. Thirty-four of the factories have been in operation throughout the year; 9 commenced operations in July, 1903, but ceased manufacturing before the close of the year, and 18 began operating subsequent to July and continued until the end of June, 1904. One factory which was licensed did not operate.

During the year the dairy inspectors, assisted by the chief of the Dairy Division, have repeatedly inspected the renovated butter factories in operation and have inspected the markets in 274 cities and towns in 44 different States and Territories. The market inspections have been for the purpose of ascertaining the extent to which renovated butter is commercially distributed and the conditions under which it is sold at wholesale and retail. Advice has been given to many distributors and dealers as to maintaining the commercial identity of the article, questionable practices have been corrected, and inspectors have cooperated with United States Treasury officials in enforcing the observance of the revenue features of the law.

The total quantity of renovated butter made at bonded factories during the fiscal year 1903–4 has been first reported (August, 1904) as 54,006,595 pounds. This is subject to revision when final reports are compiled. This shows a total rather less than the year previous, due to discontinuance of several small factories and a decrease of business by several others; but the larger factories nearly all report an output greater than that of the year preceding. The average production for the two years during which the law has been in force has been from 8 to 10 per cent greater than the estimated product of the 55 factories in operation during the year 1901–2.

Officers of the Department inspected 144 different lots of renovated butter for export, comprising 1,312,000 pounds, and certified the same to foreign countries during the first year of the operation of the law. During the second year, 367 lots have been inspected and certified for export, amounting to 3,118,018 pounds. Exports of this commodity have thus considerably more than doubled in quantity the past year.

INCREASE AND IMPROVEMENT OF RENOVATED BUTTER.

These facts show conclusively that the business of manufacturing renovated butter, as well as the exportation thereof, has prospered and materially increased since the act of May 9, 1902, took effect.

The average quality of renovated butter is still improving. The difference in general character between the product of the past year and the same commodity a few years ago is very marked. This is due in part to improved machinery and processes, and largely to the better average quality and condition of the "packing stock" or raw material used. Stock is now kept comparatively closely collected in the producing districts, so that accumulations of country butter at remote points and involving serious deterioration are of exceptional occurrence. More care is taken in sorting, packing, and storing the stock. Occasionally a lot of packing stock is found in such a condition of filth or putrefaction as to necessitate condemnation. In still rarer cases the manufactured product is found so bad, because of bad materials, ignorance, or negligence in renovating, or as the effect of age, as to make it unfit for food. In a few such instances the sanitary inspection required by law and made by this Department has caused the objectionable materials and products to be removed from the food market and sold as grease. But, as stated, such instances are very exceptional. Although there is still opportunity for great improvement in materials, in the manner of handling and transporting the same, in factory management, and in the finished product, it is true that manufacturers are endeavoring, as a rule, to improve conditions

at all points and are ambitious to win a reputation for producing an article of high quality.

BUTTER FOR THE NAVY AND THE ARMY.

The Dairy Division has continued to assist in procuring butter for the use of the United States Navy by perfecting specifications for manufacture under contract and supervising the execution of contracts. Under this system, which includes inspection by officers of this division, over 700,000 pounds of butter have been purchased during the year by the Navy Department, and the latter has acknowledged the service rendered and its satisfactory results. A much less quantity has been inspected for the Army, upon the application of purchasing officers of the Subsistence Department.

BACTERIOLOGY OF BUTTER AND CHEESE.

The experiments concerning the bacteriology of butter and cheese, which were mentioned in the last annual report of this Bureau, and which are being carried out by the Biochemic Division and the Dairy Division, have been continued. The first report of this work is embodied in Bulletin No. 57 of the Bureau of Animal Industry, and deals with the keeping qualities of canned butter. The results described therein seem to indicate that the changes which occur in canned butter and which consist in the development of disagreeable flavors are probably due to the action of enzymes, which enzymes may be produced by the action of bacteria or secreted in the udders of cows. A second paper, Bulletin No. 62, entitled "The Relation of Bacteria to Flavors in Cheddar Cheese," has also been published. These experiments are being carried further to determine the source of the enzymes producing disagreeable flavors in butter, and also to determine, if possible, the best method of avoiding their presence in butter which is made under practical conditions.

LINES OF RESEARCH.

Several lines of original investigation have been inaugurated or continued during the year, as follows:

(1) An exhaustive inquiry into the possibilities and limitations of the dairy industry in the semiarid or "short-grass" region, embracing parts of Kansas, Nebraska, Wyoming, Colorado, and Oklahoma. This included a special study of the farm cream separator in its relation to the creamery system of butter making under western conditions.

Two reports by E. H. Webster, inspector and dairy expert in charge of this inquiry, have been published as bulletins in the Bureau series.

(2) A series of careful trials have been conducted at Chicago to determine the effect of different fixed temperatures upon the quality of butter in cold storage. This work has covered the greater part of the year, and the first or preliminary report is in preparation.

(3) Similarly, a series of trials in storing cheese at different temperatures has been conducted at New York. This report is also in preparation.

(4) In cooperation with the Storrs Agricultural Experiment Station, at Storrs, Conn., an investigation has been commenced to determine specifically the principles involved in the manufacture of different varieties of soft cheese, such as are imported to this country from western Europe. It will be some time before any report can be made on this subject.

(5) In the dairy laboratory of the Bureau of Chemistry, and in the laboratory of dairy bacteriology of the Biochemic Division, Bureau of Animal Industry, investigations are being continuously carried on closely related to the dairy industry, if not bearing upon it directly. One report has been published upon the keeping qualities of butter, as noted above.

(6) Experimental exports of the best quality of creamery butter have been made weekly to Manchester, England, for several months, to make a practical test of the merits of such butter from the United States in comparison with the highest grades of butter from all other producing countries, as found in the British markets. The results were favorable in a general way, but not such as to encourage commercial operations along the same line. No report has yet been published.

REPRESENTATION AT DAIRYMEN'S MEETINGS.

During the year an effort has been made to have the Department represented at as many as possible of the State dairy conventions in the several States. The chief and assistant chief of the Division and the dairy inspectors have attended these meetings. In all, 28 such conventions have been visited in 22 different States and Territories. The work of the Bureau through the Dairy Division commends itself, as a rule, to these gatherings of representative dairymen in different parts of the country, and complimentary resolutions have been adopted by conventions in 18 States.

DAIRY WORK IN 1905.

The work of the Dairy Division during the fiscal year 1904–5 will embrace, in large measure, a continuation of that of previous years, with such additions as may promise useful results and are found practicable.

The condition of the dairy industry of the United States will be studied in all its aspects with a view to determining the most favorable opportunities and methods for progress and improvement and assisting in their accomplishment. The dairying of other countries will also be observed, productive conditions noted, the demands of consumption and of all foreign markets watched, and such action taken as is possible in the interest of extending foreign trade in the dairy products of this country. Relations will be maintained with State dairy officials with a view to cooperation in the enforcement of laws; also with the voluntary organizations of dairymen and the dairy schools in numerous States in order to be informed of their proceedings and to cooperate so far as may be advisable.

The inspection of renovated butter factories and markets will continue and be gradually extended and improved for the better administration of section 5 of the act of Congress of May 9, 1902.

The Dairy Division will conduct investigations by itself, as well as in cooperation with suitable agencies.

The experiments in storing butter at different low temperatures, which it was intended to continue and enlarge, have been abandoned because of the impossibility of finding available, in commercial storehouses, the necessary low temperature with a guaranty of maintenance without material variation. The results of the cheese-storing experiments of the past year do not seem to warrant a repetition of this work. The soft-cheese investigation in Connecticut will be continued.

It is proposed to investigate the manufacture of condensed milk and promote such action as may be deemed expedient to preserve and enhance the reputation of this country for producing this article in a form suited to foreign markets. The comparatively new industry of making "milk powder" may also receive attention.

Many communications are received on the subject of improving the milk supply of cities and towns, and especially in securing greater purity and better sanitary conditions. It is proposed to cooperate in these efforts and to give such advice and assistance as may be possible in this desirable work.

In considering the future of the Dairy Division it should be first remarked that after nine years' existence the work in hand in extending present lines of effort and taking up new ones is much greater than can be accomplished by the original organization. The dairy industry is one of the most important and most extensive branches of American agriculture. Four-fifths of all the farms in the country keep cows for milk, 17,000,000 in number, and another million are reported "not on farms." The annual product of these 18,000,000 dairy cows has a value of about $600,000,000. The opportunities for

improvement are manifest at many points. If the average cost of maintaining a cow could be lessened by intelligent economy, or the average dairy product slightly increased in quantity by rational treatment, or the average quality of dairy products raised a little by improved methods of practice, the aggregate additional profit would be very great. For example, one-third of all the butter produced in the United States is made in creameries and two-thirds on farms. The former, by reason of higher average quality, has a value of at least 3 cents per pound greater than the latter. If one-half the butter now made on farms could be made in creameries or in any way to make it as good as average creamery butter, the increased income to the producers would amount to $15,000,000 a year. Again, if the average municipal milk supply could be but slightly improved in quality and sanitary condition and the service correspondingly improved, the gain in the comfort and health of millions of people would be beyond measurement by dollars. Such improvements are entirely practicable and, in large measure, comparatively easy of accomplishment.

ANIMAL HUSBANDRY.

At the last session of Congress an appropriation of $25,000 was made for the purpose of enabling the Bureau of Animal Industry to conduct experiments in animal breeding in cooperation with the State experiment stations. Plans for this work have not yet been perfected, but arrangements have been made to conduct cooperative experiments in poultry breeding with the Maine Experiment Station in order to study the breeding of 200-egg hens, including the amount of floor space required per hen, and with the Pennsylvania Experiment Station, in addition to the work already in progress there with the respiration calorimeter, to study the influence of age and individuality on the metabolism of beef cattle. Negotiations are in progress to establish cooperative experiments in horse breeding with the Colorado Experiment Station.

A cooperative experiment with the Colorado Experiment Station has recently been made to study the feeding value of sugar-beet pulp with alfalfa hay, with and without ground corn or ground wheat. The results will be published as a bulletin of this Bureau. The experiment seems to indicate that sugar-beet pulp has considerable value for steer feeding, either with alfalfa hay without grain or in connection with grain. The best results were obtained when grain was fed, but the hay-and-pulp ration was exceedingly economical and produced excellent gains.

The importation of families, breeds, and species of domestic animals of foreign countries which are not known in the United States and

whose use promises to be of value to our animal industry has been started by the importation of four ewes and a buck of the native sheep of Barbados. These sheep are practically woolless, and are said to be valuable for mutton in warm climates. They were obtained through the courtesy of Sir Daniel Morris, imperial commissioner of agriculture for the West Indies. They will be quarantined at the experiment station of the Bureau of Animal Industry until their habits and qualities can be given careful study, after which the purpose is to send them to some point in the South for further trial.

EMIL ALEXANDER DE SCHWEINITZ.

Late chief of the Biochemic Division, Bureau of Animal Industry.

EMIL ALEXANDER DE SCHWEINITZ.

Emil Alexander de Schweinitz was born at Salem, N. C., January 18, 1864, and died at Washington, D. C., February 15, 1904. He attended the high school at Nazareth Hall, Pa., and the Moravian College at Bethlehem, Pa., and afterwards went to the University of North Carolina and to the University of Virginia. Later he went abroad and studied at the universities of Berlin and Göttingen, and subsequent to his return he taught at the Kentucky State College. He received the degree of Ph. D. from the University of North Carolina, A. M. and Ph. D. from Göttingen, and M. D. from Columbian University. While he possessed a general scientific education, chemistry was his specialty.

On the 1st of September, 1888, Doctor de Schweinitz entered the service of the United States Department of Agriculture as a laboratory assistant in the Division of Chemistry and was employed in experiments concerning the manufacture of sugar. At the beginning of the year 1890 he was appointed in the Bureau of Animal Industry, where the services of a chemist were needed in the investigation of diseases. Upon the organization of the Biochemic Division of the Bureau on July 1, 1896, he was appointed chief of that division and remained at its head to the time of his death.

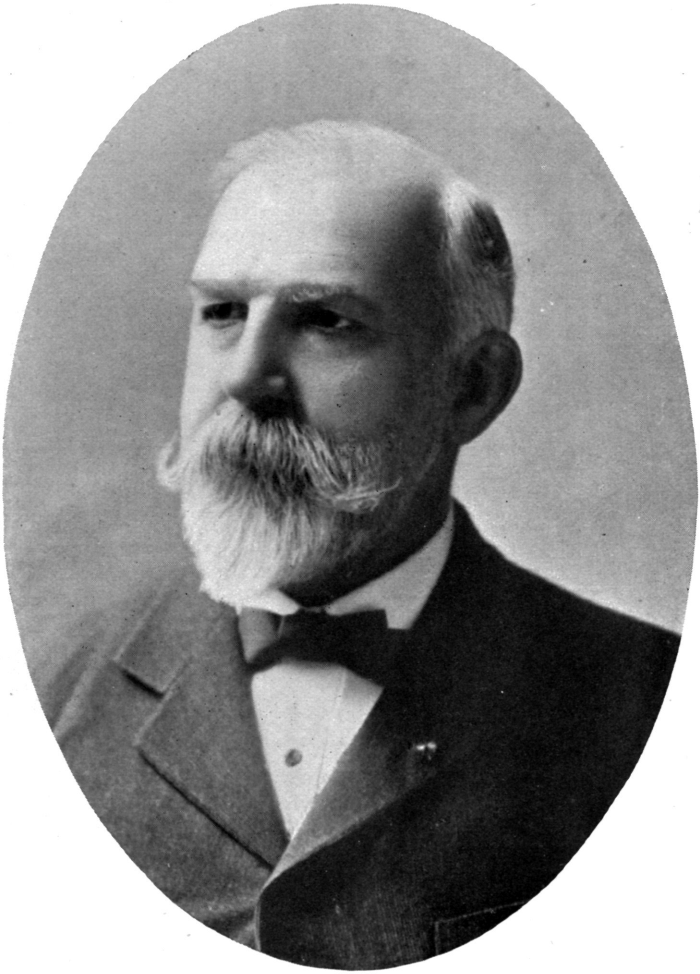
His principal work in the Bureau of Animal Industry was in connection with hog cholera and tuberculosis, and his investigations resulted in important additions to the knowledge of these subjects and secured for him a recognized place in the world of science. These diseases he studied from the chemical and bacteriological points of view and with the object of conferring immunity; he also made experiments bearing on the question of the intercommunicability of bovine and human tuberculosis. In the time following the London Congress on Tuberculosis in 1901, at which the latter subject was brought into prominence, he conducted researches which had great weight in the determination of the problems involved. In experimenting with hog cholera and allied diseases he encountered problems of a very intricate and puzzling nature, and after several years of tedious and patient work, beset with many difficulties and disappointments, he succeeded during the last year

or two of his life in clearing up some of the more important points and in obtaining results which it is hoped, when the details are worked out, will afford a clear understanding of these hog diseases and also furnish a means of controlling them.

Coincident with his governmental work, Doctor de Schweinitz was for some years connected with the medical and dental departments of the Columbian University. In 1893 he became professor of chemistry, and four years later was appointed dean of the medical faculty, a position which he held at the time of his death. In this work he combined the qualities of a skillful instructor, both in lecture room and laboratory, with executive ability of a high order. Under his administration a new college building and a new hospital were constructed and equipped, and the medical department of the university was strengthened and brought to a high degree of efficiency.

In the summer of 1903 he suffered an attack of typhoid fever, after which he never fully regained his health and strength. His death occurred after an acute illness of less than two days.

Doctor de Schweinitz contributed many articles to scientific literature. His work appears in the reports and bulletins of the Bureau of Animal Industry and in many of the medical and scientific journals. He held membership in a number of American and foreign scientific societies, among which may be mentioned the Washington Biological Society, the Washington Entomological Society, the Washington Section of the American Chemical Society (of which he was president in 1897), the Society of American Bacteriologists, the Medical Society of the District of Columbia, the American Medical Association, the American Public Health Association, the Washington Academy of Sciences, the German Chemical Society, and the French Society of Pure Chemistry. He represented the United States as a delegate to the Fourth Tuberculosis Congress, Paris, 1898; the Tuberculosis Congress, Berlin, 1899; the International Medical Congress, 1900, and the International Congress of Hygiene, Paris, 1900.



HENRY ELIJAH ALVORD.

Late chief of the Dairy Division, Bureau of Animal Industry.

HENRY ELIJAH ALVORD.

Maj. Henry Elijah Alvord was born in Greenfield, Mass., March 11, 1844, and died at St. Louis, Mo., October 1, 1904. He prepared for college in the schools of his town, and entered Norwich University early in the spring of 1860; took the civil engineering course, and gave special attention to branches applicable to architecture. Near the close of his junior year he joined the students' company of cavalry as a private, and soon became first sergeant. When the company (Seventh Squadron Rhode Island Cavalry) was mustered out, soon after the battle of Antietam, he returned to the university, and on graduating received the degrees of B. S., C. E., and, later, LL. D. Again he entered the Army, accepting a commission as second lieutenant in the Second Regiment of Massachusetts Cavalry Volunteers, and served actively in Virginia until the close of the war, at which time he held the rank of major. For more than a year he was an officer of the Freedman's Bureau under General Howard, being on duty in Virginia and South Carolina. Upon enlargement of the Regular Army in 1866 he was appointed as first lieutenant in the new Tenth Regiment of Cavalry, and was adjutant of that regiment during its organization, and promoted captain in 1867. He remained in the Army about five years, during which he served in Kansas, Texas, and the Indian Territory, and was part of the time on staff duty as inspector under General Hancock, and chief engineer of the field headquarters of General Sheridan. In 1869 he was detailed as military instructor at the Massachusetts Agricultural College, being the first army officer detailed to an agricultural college for this service.

In 1871 Major Alvord resigned from the Army. During the eight years following, while engaged as instructor in the scientific department of Williston Seminary, at East Hampton, Mass., he found time to pursue work in dairying and breeding of dairy cattle, which subjects were more to his taste, and by his writings and public addresses gained considerable reputation as an agricultural expert. It was during this time that he wrote the American chapters of Sheldon's Dairy Farming, which was one of his best works. In the early days of the Chautauqua movement he was in charge of the agricultural branch of its reading courses, known as its "school of farming,"

which was probably the first correspondence course in agriculture undertaken in this country.

Major Alvord was the pioneer in establishing the cooperative system of dairying in the United States, and established the first creamery east of the Hudson River and was the leading spirit in organizing many throughout the New England States.

In 1880 he became manager of the Houghton Farm Experiment Station, remaining at its head until the project had to be abandoned in 1885 for lack of funds. In that year he was appointed professor of agriculture at the Massachusetts Agricultural College, where he remained for two years, resigning in 1887. He was elected director of the experiment station at Cornell University upon its establishment under the Hatch Act, but declined the position to accept the presidency of the Maryland Agricultural College. He organized that institution and established the experiment station, occupying the position of president and director until 1892. He was afterwards temporarily in charge of the Oklahoma Agricultural College and Experiment Station, and went from there to the New Hampshire Agricultural College in 1894 as a professor of agriculture, where he remained for a short time.

He was prominently identified with Federal legislation relating to agricultural colleges and experiment stations, and in the formation of the Association of American Agricultural Colleges and Experiment Stations Major Alvord was the first chairman of the executive committee, which office he held for eight years. While in this position his good judgment and familiarity with methods of securing legislation made him of great service in promoting the movements which resulted in the national endowment of the agricultural colleges and experiment stations. He was president of the Association of American Agricultural Colleges and Experiment Stations in 1894, which marked the termination of his connection with that body and with the institutions represented by it.

Upon the creation of the Dairy Division in the United States Department of Agriculture, July 1, 1895, Major Alvord was appointed chief. He organized this division and its work and was at its head at the time of his death. Here the strong traits of his character were shown in his systematic and orderly business methods, attention to details, and conscientious and fearless attitude in whatever seemed to him to be right, regardless of what the general opinion of his acts would be. He had rare ability as an executive, doubtless due in part to his experience as a military officer. This, coupled with his deep insight into the dairy conditions and needs of the country, enabled him to make the Dairy Division a very efficient branch of the Department.

He was abroad in 1900 as a representative of the Department at the Paris Exposition, and was a member of the international jury of awards. In that year he traveled quite extensively in Europe, studying dairy institutions and conditions. At the time of his death he was in attendance at the St. Louis Exposition, where he had been busily engaged upon the jury of awards. He was stricken with paralysis on the afternoon of September 28, and lingered in the hospital until October 1, when he died.

Major Alvord made many addresses before State dairy meetings and contributed articles to the annual agricultural reports of various States and to American and foreign dairy journals. While in the Department he wrote a number of bulletins on timely dairy subjects, which were of great benefit to the dairy interests of the country. He held membership in a number of scientific and dairy associations in this country and abroad, among which may be mentioned the American Association for the Advancement of Science, the American Statistical Association, and the National Geographic Society. He was medalist of the Royal Agricultural Society of England and the British Dairy Farmers' Association and an "officer" of the National Order Mérite Agricole of France.

His genial nature and cordial manners won for him a very wide circle of friends. He was generous, modest, and extremely unselfish, seldom striving for personal recognition. His agricultural specialties were live stock and dairy farming, and his works and writings on these subjects ranked him among the foremost authorities in this country.

Soon after the civil war he married in Fairfax County, Va., and made his residence for some time on a large farm 10 miles west of Washington City, where Mrs. Alvord was born, and which was the homestead of her family for more than a century.

DANGER OF INFECTION WITH TUBERCULOSIS BY DIFFERENT KINDS OF EXPOSURE.

By E. C. Schroeder, M. D. V.,
Superintendent of Experiment Station, Bureau of Animal Industry,
AND
W. E. Cotton,
Expert Assistant at Experiment Station, Bureau of Animal Industry.

The experiments with which this article deals were made at the experiment station of the Bureau of Animal Industry in order to determine the comparative danger of infection with tuberculosis through different forms of exposure. For this purpose a number of guinea pigs and hogs were exposed to tubercular cattle in a manner somewhat resembling the exposure encountered by man and animals under what may be called existing, natural or normal conditions.

The guinea pigs used were divided into four lots, which, for convenience, are designated as lots A, B, C, and D. They were raised at the experiment station, and, as no case of tuberculosis has occurred among the guinea pigs at the station for a period of ten years which was not induced by an intentional or conscious inoculation or exposure, no doubt can arise as to the source of the infection through which a number of the guinea pigs in the experiments became tubercular.

Guinea pigs lot A received intraabdominal injections of milk from tubercular cows.

Guinea pigs lot B were fed the milk of tubercular cows. During the time of milk feeding, these were entirely deprived of water in order to force them to consume the maximum quantity of milk. As a rule, guinea pigs soon acquire a taste for milk, and frequently learn to like it so much that the moment the vessel containing it is placed before them they drink copiously.

Guinea pigs lot C were confined in cages fastened to the walls of box stalls occupied by tubercular cattle, at a right angle to the walls against which the mangers were located. The average size of the box stalls, in which the cows were permitted to move about unfastened, was 8 by 10 feet. The walls of the stalls were solid, 2 inches thick and 6 feet high, and the several stalls used were sufficiently separated to prevent the passage of infectious material from one to the other. The guinea-

pig cages were 2 feet wide and 1 foot deep, and had solid wooden floors and backs and open sides, fronts and tops covered with large-meshed wire. The distance from the floors of the cages to the floors of the stalls was 4½ feet, which was sufficient to prevent the cattle from throwing material directly into the cages; that is, above the horizontal line in which cattle extend their heads and necks when coughing. This form of exposure is referred to in the following records as room exposure. Its resemblance to the occupancy of rooms in common by healthy and tubercular-diseased individuals is apparent without further comment.

Guinea pigs lot D were confined in cages constructed under the mangers in stalls occupied by tubercular cattle. The arrangement was such that a small amount of feed sifted from the mangers to the cages while the cattle were eating. This form of exposure is referred to as manger exposure.

The hogs used in the experiments were simply fed milk from tubercular cows. They were kept in field pens 4½ by 12 feet in area, from 100 to 150 yards from the cow stables.

The records of the cows and of the guinea pigs and the hogs exposed to them follow:

Cow No. 1 was killed July 21, 1902. She had been affected with tuberculosis several years, and at the time of her death she was so thin and weak and suffering so severely with respiratory difficulties that it would have been cruel to prolong her life. The autopsy showed an advanced generalized tuberculosis of the thoracic and abdominal organs. One of the postpharyngeal glands was enormously enlarged and converted into a cyst which, on section, was found to contain a partly softened, tubercular, necrotic material. The total amount of disease was so great that it was difficult to understand its compatibility with the persistence of life. The udder and glands associated with it were unaffected.

Guinea pigs Nos. 1 to 4, inclusive, were fed milk of cow No. 1 from August 24, 1901, to December 27, 1901—a period of one hundred and twenty-five days. The average amount of milk consumed by each guinea pig daily was 75 c. c.

Guinea pigs Nos. 5 to 8, inclusive, were fed milk of cow No. 1 from December 27, 1901, to April 23, 1902—a period of one hundred and seventeen days. The average amount of milk consumed by each guinea pig daily was 100 c.c.

Guinea pigs Nos. 1 to 8, inclusive, were killed several months after the last day on which they were fed milk, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Guinea pigs Nos. 9 to 13, inclusive, were given room exposure to

cow No. 1, beginning August 28, 1901. They died or were killed as follows:

No. 9, died November 12, 1901, seventy-sixth day; pneumonia and inflammation of the bowels.

No. 10, died November 20, 1901, eighty-fourth day; pneumonia and inflammation of the bowels.

No. 11, died December 4, 1901, ninety-eighth day; pneumonia and inflammation of the bowels.

No. 12, died July 9, 1902, three hundred and fifteenth day; pneumonia and inflammation of the bowels.

No. 13 was exposed until July 21, 1902, three hundred and twenty-seven days, and killed on September 12, 1902; on postmortem examination was found to be in excellent condition and free from lesions of disease.

Guinea pigs Nos. 14 to 21, inclusive, were given manger exposure to cow No. 1, as follows:

No. 14, exposed August 28, 1901, died January 31, 1902, one hundred and fifty-sixth day; cause of death, pneumonia and inflammation of the bowels. No tuberculosis.

No. 15, exposed August 28, 1901, died February 3, 1902, one hundred and fifty-ninth day; cause of death, pneumonia.

No. 16, exposed August 28, 1901, died March 5, 1902, one hundred and eighty-ninth day; cause of death, pneumonia and inflammation of the bowels.

Nos. 17 and 18, exposed August 28, 1901, to July 21, 1902, three hundred and twenty-seven days.

No. 19, exposed from January 21, 1902, to July 21, 1902, one hundred and eighty-one days.

No. 20, exposed from February 12, 1902, to July 21, 1902, one hundred and fifty-nine days.

No. 21, exposed from March 5, 1902, to July 21, 1902, one hundred and thirty-eight days.

Guinea pigs Nos. 17 to 20, inclusive, were killed September 12, 1902; on postmortem examination were found to be in excellent condition and free from lesions of disease. Guinea pig No. 21, which was killed on the same day as the others, was affected with tuberculosis of the liver, spleen, and mesenteric glands.

Hog. No. 1, weight about 60 pounds, was fed 500 c. c. of milk daily from cow No. 1 for a period of eighty-eight days, beginning August 27, 1901. When the hog was killed, some time later, it was found to be in excellent condition and free from lesions of disease.

As the record of a calf produced by cow No. 1 may be of considerable interest, it is here included.

The calf was born on September 28, 1901, and was in good general condition. It was allowed to remain with its mother in the stall in which it was born. On December 2 and 3, 1901, it was tested with tuberculin and a typical reaction of the presence of tuberculosis obtained. On January 8, 1902, at the age of 102 days, it was killed, and a very careful postmortem examination failed to discover a single lesion of disease.

The reaction to tuberculin indicates that the calf was affected with tuberculosis, in a stage too early to be detected by physical examination. Had the calf been allowed to live a few months longer it is quite likely that abundant lesions would have been found. The absence of observable lesions on the one hundred and second day of life certainly indicates that the affection implied by the tuberculin test was contracted after birth, from the mother, but not intrauterus.

Cow No. 2 is alive at the present time. She has been affected with tuberculosis several years and shows all the common symptoms of generalized disease—emaciation, weakness, cough, etc. No determinable lesions of the udder or glands associated with it are present.

Guinea pigs Nos. 22 to 25, inclusive, were fed the milk of cow No. 2 from August 24, 1901, to December 27, 1901—a period of one hundred and twenty-five days. The average amount of milk consumed by each guinea pig daily was 75 c. c.

Guinea pigs Nos. 26, 27, and 28 were fed the milk of cow No. 2 from December 27, 1901, to April 24, 1902—a period of one hundred and eighteen days. The average amount of milk consumed by each guinea pig daily was 75 c. c.

Guinea pigs Nos. 22 to 28, inclusive, were killed several months after the last day on which they were fed milk, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Guinea pigs Nos. 29 to 32, inclusive, were given room exposure to cow No. 2 from December 27, 1901, to September 17, 1902—a period of two hundred and sixty-four days. They were killed several months after the termination of the exposure, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Guinea pigs Nos. 33 to 36, inclusive, were given manger exposure to cow No. 2, beginning October 27, 1901, and died or were killed as follows:

No. 33 died June 13, 1902, two hundred and twenty-ninth day; cause of death, pneumonia.

No. 34 died July 22, 1902, two hundred and sixty-eighth day; cause of death, pneumonia.

Nos. 35 and 36, exposure continued until September 12, 1902, three hundred and twenty days. The last two guinea pigs were killed some time after the termination of the exposure, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

In addition to the guinea pigs intentionally given manger exposure to cow No. 2, 11 guinea pigs, Nos. 37 to 47, inclusive, born in the exposure pen, were exposed, depending on the time of their birth, from sixty to two hundred days. Of these, No. 37 died when it was half grown, affected with generalized tuberculosis; and Nos. 38 and

39 died similarly affected after they had attained full adult size. Nos. 40 and 41 died when about half grown, affected with pneumonia; and Nos. 42 to 47, inclusive—3 half grown and 3 adult guinea pigs—were killed some time after the termination of the exposure, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Hogs Nos. 2 and 3, weight about 75 pounds, were fed daily from 300 to 500 c. c. of milk each from June 1, 1901, to October 4, 1901—a period of one hundred and twenty-five days. They were killed on November 15, 1901, and on postmortem examination were found to be in good condition and free from lesions of disease.

Cow No. 3 was received at the experiment station on August 9, 1900, at which time she was affected with advanced tuberculosis. On January 29, 1901, she was so thin and weak that it was a cause for surprise that she continued to live and secrete milk. She died May 17, 1901, and on autopsy was found to be affected with very extensive generalized tuberculosis of the thoracic and abdominal organs. No disease of the udder and the lymph glands associated with it was found.

Guinea pigs Nos. 48 to 55, inclusive, received each an intraabdominal injection of 6 c. c. of milk from cow No. 3 on February 12, 1901. The total number of guinea pigs injected was 8, 2 with milk from each quarter of the udder. The guinea pigs were killed about three months after the injections were made, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Guinea pigs Nos. 56 to 59, inclusive, were fed milk of cow No. 3 from January 29, 1901, to February 20, 1901—a period of twenty-two days. The amount of milk consumed by each guinea pig daily was about 50 c. c. Guinea pigs Nos. 60 to 63, inclusive, were fed milk of cow No. 3 from February 22, 1901, to May 12, 1901—a period of seventy-nine days. The amount of milk consumed daily by each guinea pig was about 50 c. c. Guinea pigs Nos. 56 to 63, inclusive, were killed some time after the last day on which they were fed milk, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

From February 26, 1901, to May 17, 1901—a period of eighty days—4 guinea pigs, Nos. 64 to 67, inclusive, were given room exposure to cow No. 3, and 4 guinea pigs, Nos. 68 to 71, inclusive, manger exposure to the same cow. Guinea pig No. 68, among the manger-exposed animals, died June 23, 1901, little more than a month after the termination of the exposure, and on postmortem examination was found to be affected with generalized tuberculosis. Guinea pigs Nos. 64 to 67, inclusive, and 69 to 71, inclusive, were killed some time later, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Hogs Nos. 4, 5, and 6 were fed milk of cow No. 3 from August 9, 1900, to January 28, 1901—a period of one hundred and seventy-two days. The amount of milk consumed by each hog daily was from 500 to 700 c. c. The hogs, which at the beginning of the feeding were young animals of an average weight of 40 pounds, were killed on April 22, 1901. They had greatly increased in size and weight, and on postmortem examination were found to be in excellent condition and free from lesions of disease, with the exception of No. 4. One of the superficial inguinal glands of hog No. 4 contained a few small necrotic foci; no other lesions were found. Careful microscopic examination failed to detect tubercle bacilli in the necrotic foci, and 2 guinea pigs inoculated with small fragments of the necrotic material were killed nine months later and found on postmortem examination to be in excellent condition and free from lesions of disease.

Cow No. 4 was affected with tuberculosis, but was fat, sleek, and in excellent general condition. The presence of tuberculosis without a tuberculin reaction would not have been suspected. She was killed on November 13, 1901, and on autopsy the only lesions found were enlarged tubercular mediastinal glands and one small recent focus of tuberculosis, 6 mm. diameter, embedded in the lung tissue under the pleura near the middle of the right principal lobe.

Beginning December 4, 1900, one guinea pig daily was injected with 6 c. c. of the milk of cow No. 4, until a total of 33 guinea pigs, Nos. 72 to 104, inclusive, had each received one injection. The guinea pigs were killed about three months after the injections were made, and on postmortem examination were found to be in good condition and free from lesions of disease.

Beginning December 4, 1900, 1 guinea pig daily was fed the milk from cow No. 4, until a total of 46 guinea pigs, Nos. 105 to 150, inclusive, had each been fed once. The guinea pigs were starved thirty-six hours before the milk was offered them, and after it was placed in the cage no food or water was allowed until at least 40 c. c. had been consumed. When the guinea pigs were killed, about three months later, the postmortem examination showed that they were in excellent condition and free from lesions of disease.

From February 28, 1901, to July 27, 1901—a period of one hundred and forty-nine days—5 guinea pigs, Nos. 151 to 155, inclusive, were given room exposure to cow No. 4, and 5 guinea pigs, Nos. 156 to 160, inclusive, manger exposure to the same cow. A short time after the termination of the exposure, one manger-exposed guinea pig, No. 156, died, and on postmortem examination was found to be affected with generalized tuberculosis. The remaining guinea pigs, as well as 8

young guinea pigs, Nos. 161 to 168, inclusive, which were born in the room-exposure pen and were exposed from fifty to one hundred days, were killed some time later, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Hogs Nos. 7 and 8, young animals, weight about 40 pounds each, were fed daily about 500 c. c. of milk each from cow No. 4 from November 28, 1900, to May 22, 1901—a period of one hundred and seventy-five days. They were killed some time after the last day on which they were fed milk, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Cow No. 5 had been suffering with tuberculosis a long time and had a severe cough and was very thin and weak. She was killed on November 13, 1901, and on autopsy abundant tubercular lesions were found in the throat, mediastinal glands, and mesenteric glands, in the lung, liver, and spleen, and numerous tubercular excrescences on the costal and pulmonary pleura and the omentum. The lung contained several large tubercular abscesses in communication with bronchial tubes. No lesions of the udder or the lymph glands associated with it were found.

The record of cow No. 5, relative to guinea pigs injected and fed with milk obtained from her, and given room exposure and manger exposure in the stall she occupied (guinea pigs Nos. 169 to 257, inclusive), is in all respects identical with the record of cow No. 4, with the exception that no guinea pigs became affected with tuberculosis.

Cow No. 6 had been affected with tuberculosis for several years and was very thin and weak, and suffered with frequent severe paroxysms of cough. Died on August 12, 1904, after she had been down and unable to regain her feet, because of extreme weakness, for two or three days. The autopsy showed an advanced, extensive, generalized tuberculosis of the thoracic and abdominal organs. There were no visible lesions of the udder or the lymph glands associated with it.

From January 18, 1904, to February 8, 1904, 6 guinea pigs daily were injected intraabdominally with 6 c. c. each of milk from cow No. 6. The total number of guinea pigs injected was 132—Nos. 258 to 389, inclusive. The guinea pigs were killed about three to four months after the injections were made, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Hogs Nos. 9 and 10, in good condition; average weight, about 50 pounds. They were each fed daily from 500 to 700 c. c. of milk from cow No. 6 from June 1, 1901, to August 27, 1901—a period of eighty-seven days. The hogs were fed several years before the guinea-pig injections were made, and, as would be expected, when they were killed the postmortem examination showed that they were in excellent health and free from lesions of disease.

Hogs Nos. 11, 12, and 13 were in good condition; average weight, about 40 pounds. They were fed milk from cow No. 6 from October 15, 1901, to July 7, 1902—a period of two hundred and sixty-five days. The amount of milk eaten daily by each hog was from 500 to 700 c. c. The hogs were killed on January 27, 1903, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Cow No. 7 is still alive. She is very weak and thin and has been affected with tuberculosis for several years. During the last year her condition has been so poor that it is difficult to understand how she remains alive. No determinable lesions of the udder and the lymph glands associated with it are present.

Six guinea pigs—Nos. 390 to 395, inclusive—were fed milk of cow No. 7 from April 15, 1903, to December 22, 1903—a period of two hundred and fifty-one days. The amount of milk consumed daily by each guinea pig averages 70 c. c. The guinea pigs were killed some time after the last day on which they were fed milk, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Six guinea pigs—Nos. 396 to 401, inclusive—were fed milk of cow No. 7 from December 22, 1903, to December 14, 1904—a period of three hundred and fifty-seven days. The average amount of milk consumed by each guinea pig daily was 70 c. c. The guinea pigs were killed on December 21, 1904. One guinea pig, No. 396, was found on postmortem examination to be affected with generalized tuberculosis, and 5—Nos. 397 to 401, inclusive—were in excellent condition and free from lesions of disease.

Fifteen guinea pigs received each an intraabdominal injection of 5 c. c. of the milk of cow No. 7, as follows:

April 15, 1903, guinea pigs Nos. 402, 403, and 404.
July 14, 1904, guinea pigs Nos. 405, 406, 407, and 408.
July 22, 1904, guinea pigs Nos. 409, 410, 411, and 412.
August 12, 1904, guinea pigs Nos. 413, 414, 415, and 416.

The guinea pigs were killed from two to three months after the injections in each case were made and examined postmortem.

Guinea pigs Nos. 402 and 403, injected on April 15, 1903, were found to be affected with generalized tuberculosis. Guinea pig No. 404, injected on the same date, and guinea pigs Nos. 405 to 416, inclusive, injected on the later dates, were found to be in excellent condition and free from lesions of disease.

Cow No. 8 died on June 12, 1903, previous to which time she was so weak and thin that she could barely stand on her feet. The autopsy showed a generalized tuberculosis, but without lesions in the udder and the glands associated with it.

Three guinea pigs—Nos. 417, 418, and 419—received each an intra-

abdominal injection of 5 c. c. of the milk from cow No. 8 on April 15, 1903. Two of the guinea pigs, Nos. 417 and 418, died about two months later, and on postmortem examination were found to be affected with generalized tuberculosis. Guinea pig No. 419 was killed four months after the injection was made, and on postmortem examination was found to be in good condition and free from lesions of disease.

Five guinea pigs—Nos. 420 to 424, inclusive—were fed milk of cow No. 8 from April 15, 1903, to June 8, 1903—a period of fifty-five days. The average amount of milk consumed by each guinea pig daily was 70 c. c. When the guinea pigs were killed, some time after the last day on which they were fed milk, and examined postmortem, they were found to be in excellent condition and free from lesions of disease.

Cow No. 9 was killed March 14, 1902. Her general condition was excellent—fat. The autopsy showed a generalized tuberculosis of the thoracic and abdominal organs, with numerous and voluminous lesions. There was absolutely nothing in the condition of the cow during life to indicate the extensive character of the disease with which she was affected.

Four guinea pigs, Nos. 425 to 428, inclusive, were given room exposure to cow No. 9, and four others, Nos. 429 to 432, inclusive, manger exposure to the same cow, from January 2, 1902, to March 14, 1902—a period of seventy-one days. One young guinea pig, No. 433, was born in the manger pen and was exposed about sixty days.

The nine guinea pigs were killed on April 26, 1902. Guinea pig No. 425 (room exposure) was found on postmortem examination to be affected with generalized tuberculosis. Guinea pig No. 426 (room exposure) was found on postmortem examination to be affected with tuberculosis of the lung and liver. Guinea pigs Nos. 427 and 428 (room exposure) and guinea pigs Nos. 429 to 433, inclusive (manger exposure), on postmortem examination were found to be in good condition and free from lesions of disease.

Cow No. 10 was killed November 23, 1901. The autopsy showed a generalized tuberculosis of the thoracic and abdominal organs, with numerous and voluminous lesions. The throat glands were greatly enlarged and completely tubercular. No disease of the udder and the lymph glands associated with it was detected.

Two hogs, Nos. 14 and 15, in good condition, with an average weight of 40 pounds, were fed milk from cow No. 10 from August 27, 1901, to November 23, 1901—a period of eighty-eight days. The amount of milk eaten by each hog daily was 1,000 c. c.

The hogs were killed June 13, 1902, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Cow No. 11 was killed November 23, 1901. The autopsy showed extensive tubercular disease of the mediastinal glands and lung. The latter contained several large abscesses in communication with the bronchial tubes, and the bronchial tubes contained flakes of tubercular material, which was discharging from the abscesses. No other lesions were found.

Four hogs, Nos. 16 to 19, inclusive, were fed the milk from cow No. 11, as shown below. The hogs were in good condition at the time the feeding was begun and averaged about 40 pounds in weight. The daily quantity of milk eaten by each hog during the time it was fed was 1,000 c. c.

Hogs Nos. 16 and 17 were fed from October 23, 1900, to February 23, 1901—a period of one hundred and twenty-three days. The hogs were killed April 22, 1901, and on postmortem examination were found to be in excellent condition and free from lesions of disease.

Hog No. 18 was fed from August 24, 1901, to September 21, 1901—a period of twenty-eight days. It died on September 21, 1901, and on autopsy was found to be affected with hog cholera. No lesions of tuberculosis.

Hog No. 19 was fed from August 24, 1901, to November 23, 1901—a period of ninety-one days. Killed May 23, 1902, and on postmortem examination showed lesions of chronic hog cholera. No lesions of tuberculosis were present.

The results obtained from the various exposures made to the 11 tubercular cows used in the experiments are condensed in the following five tables:

TABLE 1.—*Guinea pigs, lot A—Intraabdominal milk injections.*

No. of cow.	No. of guinea pig.	Date of injection.	Amount of milk injected, each guinea pig.	Results.
			c. c.	
3	48–55	Feb. 12, 1901	6	No disease.
4	72–104	1 daily from Dec. 4, 1900, to Jan. 5, 1901, inclusive.	6	Do.
5	169–201	do	6	Do.
6	258–389	6 daily from Jan. 18 to Feb. 8, 1904.	6	Do.
7	402, 403, 404	Apr. 15, 1903	5	402 and 403, generalized tuberculosis; 404, no disease.
7	405–408	July 14, 1904	5	No disease.
7	409–412	July 22, 1904	5	Do.
7	413–416	Aug. 12, 1904	5	Do.
8	417, 418, 419	Apr. 15, 1903	5	417 and 418, generalized tuberculosis; 419, no disease.

The milk used for the intraabdominal injections of guinea pigs was obtained from 6 tubercular cows—Nos. 3 to 8, inclusive. Of these, Nos. 3, 6, and 8 died as the result of generalized tuberculosis; No. 4 was killed and found on autopsy to be only slightly affected; No. 5 was killed and found to be affected with generalized tuberculosis, and No. 7 is still alive, but undoubtedly affected with generalized tuberculosis. No observable disease of the udder was present in any case.

The number of guinea pigs that received injections was 224, and of these, 4, or 1.78 per cent, became tubercular. The total amount of milk injected into all the guinea pigs was 1,326 c. c., or about 3 pints.

TABLE 2.—*Guinea pigs, lot B—Milk feeding.*

No. of cow.	No. of guinea pig.	Date of feeding.	Number of days of feeding.	Amount of milk per day for each guinea pig.	Results.
				c. c.	
1	1-4	Aug. 24, 1901, to Dec. 27, 1901.	125	75	No disease.
1	5-8	Dec. 27, 1901, to Apr. 23, 1902..	117	100	Do.
2	22-25	Aug. 24, 1901, to Dec. 27, 1901.	125	75	Do.
2	26, 27, 28	Dec. 27, 1901, to Apr. 24, 1902.	118	75	Do.
3	56-59	Jan. 29, 1901, to Feb. 20, 1901.	22	50	Do.
3	60-63	Feb. 22, 1901, to May 12, 1901.	79	50	Do.
4	105-150	1 guinea pig daily, Dec. 4, 1900, to Jan. 18, 1901.	1	40	Do.
5	202-247	.....do	1	40	Do.
7	390-395	Apr. 15, 1903, to Dec. 22, 1903.	251	70	Do.
7	396-401	Dec. 22, 1903, to Dec. 14, 1904.	357	70	Guinea pig 396, generalized tuberculosis; guinea pigs 397 to 401, inclusive, no disease.
8	420-424	Apr. 15, 1903, to June 8, 1903.	55	70	No disease.

The milk fed to the guinea pigs was obtained from 7 cows, Nos. 1 to 5, inclusive, and Nos. 7 and 8. Of these, Nos. 3 and 8 died as the result of generalized tuberculosis; Nos. 1 and 5 were killed, and on autopsy found to be affected with generalized tuberculosis; No. 4 was killed and found to be only slightly affected, and Nos. 2 and 7 are still alive, but undoubtedly affected with generalized tuberculosis.

The number of the guinea pigs that were fed milk was 132, and of these only 1, or 0.76 per cent, became tubercular. The guinea pig which contracted tuberculosis was 1 of 6 which were fed daily for three hundred and fifty-seven days the milk of cow No. 7, which is still alive. The amount of milk fed was 446,490 c. c., or about 118 gallons. The average duration of the feeding was forty-seven and one-fifth days.

TABLE 3.—*Guinea pigs, lot C—Room exposure or wall-pen exposure.*

No. of cow.	No. of guinea pig.	Date of exposure.	Duration of exposure.	Results.
			Days.	
1	9	Aug. 28, 1901, to Nov. 12, 1901.	76	Pneumonia and inflammation of bowels.
1	10	Aug. 28, 1901, to Nov. 20, 1901.	84	Do.
1	11	Aug. 28, 1901, to Dec. 4, 1901.	98	Do.
1	12	Aug. 28, 1901, to July 9, 1902.	315	Do.
1	13	Aug. 28, 1901, to July 21, 1902.	327	No disease.
2	29–32	Dec. 27, 1901, to Sept. 17, 1902.	264	Do.
3	64–67	Feb. 26, 1901, to May 17, 1901.	80	Do.
4	151–155	Feb. 28, 1901, to July 27, 1901.	149	Do.
4	161–168	April to July, 1901	50–100	Do.
5	248–252	Feb. 28, 1901, to July 27, 1901.	149	Do.
9	425–428	Jan. 2, 1902, to Mar. 14, 1902.	71	No. 425, generalized tuberculosis; No. 426, tuberculosis of liver and lung; Nos. 427 and 428, no disease.

The room exposures or wall-pen exposures were made to 6 cows, Nos. 1 to 5, inclusive, and No. 9. Of these Nos. 1, 5, and 9 were killed, and on autopsy were found to be affected with generalized tuberculosis; No. 2 is still alive, but undoubtedly affected with generalized tuberculosis; No. 3 died as the result of generalized tuberculosis, and No. 4 was killed and found to be only slightly affected.

The number of guinea pigs that received room exposure was 35, and of these, 2, or 5.71 per cent, became tubercular. The average duration of the exposures was one hundred and thirty-five days.

TABLE 4.—*Guinea pigs, lot D—Manger exposure or manger-pen exposure.*

No. of cow.	No. of guinea pig.	Date of exposure.	Duration of exposure.	Results.
			Days.	
1	14	Aug. 28, 1901, to Jan. 31, 1902.	156	Pneumonia and inflammation of bowels.
1	15	Aug. 28, 1901, to Feb. 3, 1902.	159	Pneumonia.
1	16	Aug. 28, 1901, to Mar. 15, 1902.	189	Pneumonia and inflammation of bowels.
1	17, 18	Aug. 28, 1901, to July 31, 1902.	337	No disease.
1	19	Jan. 21, 1902, to July 21, 1902.	181	Do.
1	20	Feb. 12, 1902, to July 21, 1902.	159	Do.

TABLE 4.—*Guinea pigs, lot D—Manger exposure or manger-pen exposure*—Cont'd.

No. of cow.	No. of guinea pig.	Date of exposure.	Duration of exposure.	Results.
			Days.	
1	21	Mar. 5, 1902, to July 21, 1902.	138	Tuberculosis of liver, spleen, and mesenteric glands.
2	33	Oct. 27, 1901, to Jan. 13, 1902.	229	Pneumonia.
2	34	Oct. 27, 1901, to July 22, 1902.	268	Do.
2	35, 36	Oct. 27, 1901, to Sept. 12, 1902.	320	No disease.
2	37–47	December, 1901, to September, 1902.	60–200	No. 37, half-grown guinea pig, generalized tuberculosis; Nos. 38 and 39, full-grown guinea pigs, generalized tuberculosis; Nos. 40 and 41, pneumonia; Nos. 42 to 47, inclusive, no disease.
3	68–71	Feb. 26, 1901, to May 17, 1901.	80	No. 68, generalized tuberculosis; Nos. 69 to 71, inclusive, no disease.
4	156–160	Feb. 28, 1901, to July 27, 1901.	149	No. 156, generalized tuberculosis; Nos. 157 to 160, inclusive, no disease.
5	253–257	.....do..................	149	No disease.
9	429–432	Jan. 2, 1902, to Mar. 14, 1902.	71	Do.
9	433	January to March, 1902.	60	Do.

Guinea pigs lot D were exposed to the same cows to which guinea pigs lot C, Table 3, were exposed. The total number of guinea pigs that received manger exposure was 42, and of these 6, or 14.28 per cent, became tubercular. The average duration of exposure was one hundred and fifty-one and one-half days.

TABLE 5.—*Milk feeding of hogs.*

No. of cow.	No. of hog.	Date of feeding.	Duration of feeding.	Amount of milk per day.	Results.
			Days.	*c. c.*	
1	1	Aug. 27, 1901, to Nov. 23, 1901	88	500	No disease.
2	2, 3	June 1, 1901, to Oct. 4, 1901........	125	300–500	Do.
3	4, 5, 6	Aug. 9, 1900, to Jan. 28, 1901.......	172	500–700	Do.
4	7, 8	Nov. 28, 1900, to May 22, 1901......	175	500	Do.
6	9, 10	June 1, 1901, to Aug. 27, 1901......	87	500–700	Do.
6	11, 12, 13	Oct. 15, 1901, to July 7, 1902.......	265	500–700	Do.
10	14, 15	Aug. 27, 1901, to Nov. 23, 1901	88	1,000	Do.
11	16, 17	Oct. 23, 1900, to Feb. 23, 1901.......	123	1,000	Do.
11	18	Aug. 24, 1901, to Sept. 21, 1901....	28	1,000	Hog cholera.
11	19	Aug. 24, 1901, to Nov. 23, 1901	91	1,000	Chronic hog cholera.

The hogs were fed milk obtained from 7 tubercular cows, Nos. 1 to 4, inclusive, and Nos. 6, 10, and 11. Of these, Nos. 1 and 10 were killed and found to be affected with generalized tuberculosis; No. 2 is alive, but undoubtedly affected with generalized tuberculosis;

Nos. 3 and 6 died, and on autopsy the cause of death was found to be generalized tuberculosis; and Nos. 4 and 11 were killed and the former found on autopsy to have only slight and the latter severe tuberculosis of the lung.

The number of hogs that were fed milk was 19, and of these not one became tubercular. The total amount of milk fed was 1,751,000 c. c., or about 462¼ gallons. The average duration of the feeding was one hundred and forty-three days.

The positive results obtained from the several exposures compare as follows:

	Per cent.
Milk injection, guinea pigs	1.78
Milk feeding, guinea pigs	.76
Room exposure, guinea pigs	5.71
Manger exposure, guinea pigs	14.28
Milk feeding, hogs	0.00

The percentages given do not correctly illustrate the delicacy of intraabdominal injections of guinea pigs as a test for the presence of tubercle bacilli. It is better shown by more careful study of the guinea pigs used in the milk-injection and milk-feeding experiments.

The 224 injected guinea pigs received altogether only 1,326 c. c. of milk, while the 132 fed guinea pigs received a total of 446,490 c. c. of milk; that is, the latter received 336 times as much milk as the former guinea pigs. An even more emphatic illustration of the delicacy of the injection test is given in the results with the milk of cows Nos. 7 and 8, the only cows in the experiments the milk of which produced positive results. Injections were made with the milk of the 2 cows at the same time that the milk was being fed, and the numbers of guinea pigs that were injected and fed were almost equal. The total amount of milk injected into 18 guinea pigs from cows Nos. 7 and 8 was 90 c. c., and this produced 4 cases of tuberculosis—2 with the milk from each cow. The total amount of milk from cows Nos. 7 and 8 fed to 17 guinea pigs was 274,610 c. c., and this produced only 1 case of tuberculosis. The positive case was one of 6 guinea pigs fed the milk of the less severely affected cow for three hundred and fifty-seven consecutive days, during which time the guinea pigs each consumed an average of 70 c. c. of milk daily. The milk that was injected was in proportion to the milk that was fed as 1 to 3,051⅓, and the positive results were 4 from injections and 1 from feeding. If we assume that the occurrence of tubercle bacilli was fairly constant in the milk of the 2 cows, the mathematical value of the injection test in this particular experiment is shown to be over 12,000 times as great as the value of the ingestion test.

This matter has been gone into at some length because it demon-

strates that the danger of infection with tuberculosis through the use of milk, while very important in itself, is very slight as compared with other sources of infection, and because this lesser danger is extremely significant in connection with several recently developed facts concerning tuberculosis in man.

We know to-day, by all the tests we can legitimately apply, that tubercle bacilli isolated from lesions in cattle are more virulent than bacilli isolated from lesions in man, and that the majority of tubercle bacilli found in human lesions, which are sufficiently virulent to infect cattle, are obtained from children. Some of the followers of Dr. Robert Koch assert, in their insistence that human and bovine tuberculosis are different diseases, that tubercle bacilli isolated from man that possess sufficient virulence to infect cattle are bovine bacilli, with which man has somehow, in some surprising manner, become infected. And this conclusion they strengthen by pointing out peculiarities in the morphology of the bacilli which failed to select their proper host.

We know that the only real source of infection with tuberculosis through cattle, to which children are ordinarily exposed, is the milk they drink. Hence, if guinea pigs, which have always been regarded as highly susceptible to tuberculosis, can daily, for long periods of time, drink large quantities of milk from cows known to be affected with generalized tuberculosis, and in some cases milk in which the presence of tubercle bacilli has been demonstrated by the intra-abdominal injection of other guinea pigs, without becoming infected with tuberculosis; and the greater frequency in the lesions of tubercular children of bacilli of sufficient virulence to infect cattle counts for anything, no possible feeling of uncertainty can remain to weaken the conclusion that children, at any rate, are very susceptible to cattle tuberculosis.

In this connection a reference made in a recent number of the British Medical Journal and in other publications to the latest recorded observations of the German Committee for the Investigation of Tuberculosis, which came into existence after the declaration of Doctor Koch for the distinctive grouping of human and bovine tubercle bacilli, is of great interest. We are told that 56 different tubercle bacilli were isolated from human lesions, and that 6 of them, or 10.71 per cent, were found to be bovine tubercle bacilli. The human bacilli are distinguished from the bovine by morphological characteristics. We are also told that tubercle bacilli are constant in their varietal character, hence human bacilli are always human bacilli and bovine bacilli likewise always bovine bacilli. There may be much light thrown on these statements through an examination of the investigations in detail on which they are supported, but in their present form they constitute an amazing series of declarations, which, if

taken seriously, point to a number of highly interesting and equally important conclusions.

It has already been stated that the greatest danger of infection with tuberculosis through cattle to which man is exposed is milk; to this should be added butter and possibly cheese and the exposure of men whose occupations place them in frequent contact with cattle. Meat, which is rarely eaten in a raw state, and usually, if at all infected, is so infected through the germs which have reached its outer surface (the part most exposed to the sterilizing effects of the heat applied in cooking) through contact with a soiled knife or hand or other infected material need hardly be referred to. The exposure of man to human tubercular infection is infinitely greater, and this fact is generally admitted. The bacilli encounter him everywhere—on the streets, in public rooms, in public conveyances, on articles of food handled by affected persons and not afterwards sterilized by the application of heat, carried into his house on his own clothing and especially on the long skirts of women, in the books obtained from libraries, and, in one of the worst forms, in the atmosphere while conversing with tubercular-affected persons, etc. And yet, a responsible investigating committee, composed of men presumably selected with a careful regard for their ability to deal with the subject, announces that over 10 per cent of the tubercle bacilli isolated by them from human lesions in a series of special investigations are bovine tubercle bacilli, and that bovine tubercle bacilli are morphologically constant organisms. It almost justifies the assumption, when we bear in mind that human bacilli are rarely virulent for cattle and a number of other animals and that bovine bacilli are infectious for a great variety of animals—the Quadrumana, the closest possible biological approach to man, included—that tuberculosis of man would be a much simpler problem to deal with if the constantly occurring accretions of superlatively virulent bacilli through the milk pail could be effectually stopped. At least no stronger or more valid reason could be given to make persistent and untiring efforts to remove every trace of tuberculosis from our dairy herds. The numerous new facts which have been established through the increased activity given the investigation of tuberculosis by Doctor Koch's famous London utterances all tend to support this conclusion.

The several cows used in the experiments merit a more detailed separate discussion, because it seems to us that a number of valuable conclusions can be drawn from them.

The tuberculosis with which cow No. 1 was affected was sufficiently advanced and of a kind at the time the exposures were made to her for a dairyman or person experienced in the common care of cattle to make a diagnosis. Among the 8 guinea pigs and 1 hog that were

fed milk and the 5 room-exposed and 8 manger-exposed guinea pigs, only 1, a manger exposure, became affected with tuberculosis. The percentage of positive results, 4.55, is unexpectedly small from exposure to a cow so severely affected, but amply large to demonstrate the dangerous character of her disease.

Little can be added to the record of cow No. 2. The disease with which she is affected is evidently of the kind which progresses very slowly. She was known to be tubercular as early as the year 1900, and is now (January, 1905) alive, and her condition gives every promise that she will last a year or possibly two years longer. Among the 7 guinea pigs and 2 hogs that were fed milk and the 4 room-exposed and 15 manger-exposed guinea pigs, 3, or 10.71 per cent, contracted tuberculosis. The 3 guinea pigs which became affected belonged to the 11 animals born in the manger pen and constitute 27¼ per cent of these young animals. This result speaks strongly for the conclusion that young animals are more susceptible to tuberculosis than older animals.

It is a fact worthy of note that the exposure of the guinea pigs which contracted tuberculosis from cow No. 2 ended September 12, 1902, or about two and one-fourth years ago, and hence that the cow was spreading tubercle bacilli at that time and probably has been doing so ever since, and will continue to do so until she is dead. It can not be supposed that she has improved in this respect. Tuberculosis is a progressive disease and not a self-limited affection; hence it is fair to assume that an animal from which tubercle bacilli were being eliminated at any time may be an animal from which an equal or greater number of tubercle bacilli are probably being eliminated at any subsequent time. The cow is emphatically one of the cases of tuberculosis, of which there are doubtless many in dairy herds, that help to keep up the supply of infectious material. The practical conclusion to be drawn from her is the absolute necessity of the separation of all tubercular cattle from contact with other animals the moment the existence of tubercular disease is discovered through the use of tuberculin or by other methods.

The condition of cow No. 3, in consequence of the tubercular disease with which she was affected, was such that she should have been retained in no dairy herd. Among the 8 guinea pigs that received intraabdominal injections of milk, the 8 that were fed milk, and the 4 guinea pigs that received room exposure, and the 4 that received manger exposure, and the 3 hogs that were fed milk, only 1 animal, a manger-exposed guinea pig, contracted tuberculosis—1 out of a total of 27, or 3.7 per cent. As in the case of cow No. 1, the number of positive results from the exposures is surprisingly small.

The amount of tuberculosis found in cow No. 4 on postmortem examination was very small, and of a kind which was in no visible

communication with the exterior of the animal; but that she was spreading tubercle bacilli is shown to be a fact by the development of tuberculosis in one of the guinea pigs exposed to her. She was in excellent condition—so fat that she would have made a good beef animal. She was young, and showed absolutely no symptoms from which tuberculosis could be diagnosed without the aid of tuberculin. If a tuberculin test had not led to her separation from the dairy herd to which she originally belonged, it is very probable that she would have remained alive and an active agent for the infection of other cattle during a year or two or possibly for even a longer time.

Cow No. 4 shows even more emphatically than cow No. 2 how absolutely necessary it is for the eradication of tuberculosis from a herd of cattle to remove every animal to which the least suspicion of tuberculosis attaches.

In anticipation of the claims that the guinea pigs exposed to the several cows in this series of experiments do not constitute a fair test of the dangerous character of tubercular cows for other cattle, because of the generally believed high susceptibility of guinea pigs to tuberculosis, attention is called to an experiment published in the Twentieth Annual Report of the Bureau of Animal Industry. In the experiment referred to, 7 healthy cattle were exposed to 3 tubercular cows, and at the same time 100 guinea pigs received room exposure and manger exposure to the same tubercular cows. At the end of the exposure the cattle and guinea pigs were killed and examined post-mortem. The examination showed that 6 of the 7 cattle, or 85.71 per cent, had become tubercular, and that only 1 of the guinea pigs, or 1 per cent, had become infected. It is quite possible that the number of strictly virulent tubercle bacilli which must enter the body of a cow to cause a progressive tubercular disease is no larger than the number required to infect a guinea pig. If this is true, the results obtained in the experiment in which the cattle and guinea pigs were simultaneously exposed are precisely in accordance with what should have been expected, because the cattle breathed a much larger volume of dust-ladened and tubercle-infected air and consumed a much larger mass of possibly soiled and infected forage than the guinea pigs. Hence, also, the fact that 1 of the guinea pigs which received room exposure and manger exposure to cow No. 4 became tubercular must be regarded as indicating that the cow was an exceptionally dangerous animal, notwithstanding the comparatively slight lesions found on autopsy.

The amount of tuberculosis found in cow No. 5, on the other hand, was enormous, and abscesses existed in the lung and were in direct communication with the bronchial tubes. The absence of disease among the guinea pigs exposed to her is more surprising than the

infection of every one of them would have been. The cow, when compared with cows Nos. 2 and 4, justifies the important conclusion that visible and more extensively tubercular cattle are by no means always the greater menace to other animals exposed to them. Animals like cow No. 5—thin, weak, coughing, and displaying a whole group of symptoms characteristic of distress and advanced disease—also have the advantage, in matters related to the restriction of disease among man and animals, that their very condition is a warning against contact and intimate association. Such animals are instinctively avoided, because we all know that disease carries with it many unknown possibilities of transference, in addition to those that are recognized, from the already affected to the still unaffected. Cow No. 5 is clearly the danger we recognize and avoid, and cow No. 4 is equally the danger, of no less magnitude, which borrows an unpleasant additional potency from its concealed nature, and is for that reason one of the strongest arguments that can be presented for the application of the tuberculin test to all cattle and for the immediate slaughter of all cattle that react.

It is remarkable that not one of the 132 guinea pigs injected (6 daily for a period of twenty-two days) with milk from cow No. 6 became affected with tuberculosis. The cow had been tubercular several years at the time the guinea-pig injections were made, and died six months later as the result of generalized tuberculosis. In connection with this cow it should be borne in mind that the milk used for feeding and injection exposures was taken from the various cows used, with the greatest precautions to prevent its infection with bacilli present in the air or dust in the stable, with infected bedding or particles of forage, or with bacilli adherent to the hair and skin of the cows or on the hands of the persons who milked the cows. It does not seem quite reasonable to suppose that tubercle bacilli should occur commonly in the milk of tubercular cows with unaffected udders unless they reach it in some way not directly associated with the normal milk-secreting functions. While we have no satisfactory evidence to offer for or against the passage of tubercle germs from the bodies of tubercular animals through unaffected normal secreting organs, it is our impression that bacteria which, like tubercle bacilli, localize themselves in the body and rarely float in the blood are seldom eliminated through any kind of healthy organs, the udder included.

If this view is as true as it seems reasonable, we must attribute the frequently present tubercular infection in the milk of cows to other causes than its passage from the animal through the udder. Such causes would be the infection of the milk in one of the ways we tried to avoid by the special precautions previously specified or by some

other similar means. And this points to another danger through the use of milk, because, in a stable containing both healthy and diseased animals, the milk from the healthy is probably just as unwholesome and dangerous as the milk from the diseased, and this is an additional argument for the general application of the tuberculin test to cattle and the immediate slaughter of all reacting animals.

Cow No. 7, affected with advanced tuberculosis, is still alive. The milk drawn from her on April 15, 1903, produced tuberculosis in 2 of 3 guinea pigs injected with it. Milk drawn from the same cow more than a year later, on three different days—July 14, July 22, and August 12, 1904—and injected, respectively, into three lots of 4 guinea pigs each, failed to produce disease. The absence of disease in 1 of the first 3 guinea pigs injected seems to signify that either the distribution of the tubercle bacilli in the milk was not at all uniform or that the number of bacilli present was very small. The absence of disease in the 12 guinea pigs injected in 1904, at a time when the symptoms of tuberculosis in the cow were very much more marked, almost justifies the conclusion that the milk injected on the earlier date became infected with tubercle bacilli in some other way than through the milk-secreting structures of the cow—that is, notwithstanding the precautions taken to prevent the occurrence with bacilli which reached the milk from the exterior of the cow, either from her hair or skin, or by the accidental entrance of some small infected particles of material discharged by the animal at the time she was being milked, from her nose or mouth, directly into the pail or on the hands of the person who milked on the day in question. The latter is fairly probable, because it was the milk from cow No. 8, of April 15, 1903, the same day, which produced the only two other positive results obtained with intraabdominal injections of milk from cows with unaffected udders.

The 5 guinea pigs that were fed daily with milk from cow No. 8 during fifty-five consecutive days remained unaffected, and among the 12 guinea pigs that were fed milk from cow No. 7—6 for a period of two hundred and fifty-one days and 6 for a period of three hundred and fifty-seven days—only 1 contracted tuberculosis, and that one was among the 6 which daily consumed 70 c. c. of milk each for a period of three hundred and fifty-seven days. The time is certainly of sufficient length to justify the assumption that even the greatest precautions, most carefully practiced, failed in one instance to prevent the entrance into the milk of infectious material from the exterior of the animal, possibly in the form of a particle of forage or a mass of mucous which infected the guinea pig that happened to swallow it. The other alternative is to suppose that tubercle bacilli occur periodically in the milk of tubercular cows with apparently

healthy udders in numbers insufficient to affect guinea pigs on ingestion unless they are unusually susceptible to tuberculosis. We feel confident, however, that no disease would have occurred among the milk-fed guinea pigs if every source of milk infection from the exterior could have been effectually eliminated, and that probably all the guinea pigs that were fed milk for very long periods of time would have become affected with tuberculosis if the tubercular cows had been milked with no greater precautions to prevent infection of the milk from without than is practiced, or can be conveniently and economically practiced, in the great majority of dairy stables. And here, again, we have an argument for the complete removal of all tubercular cows from dairy herds.

It is a matter of indifference to the sufferer whether the cause of his affliction reached him through the secretory structures of a food-producing animal or through the contamination of food because of its exposure to an unclean environment. The view we express of the possible infection of the milk of cows Nos. 7 and 8 with tubercle bacilli from other sources than the apparently normal secreting structures of the udder is only conjectural, and it is gone into at some length mainly to accentuate our conviction that the infection of milk with tubercle bacilli through other sources than unaffected udders of tubercular cows is the much greater danger.

Cow No. 9 is an excellent illustration of a frequently observed fact, namely, the absence of visible symptoms of disease in the presence of advanced tuberculosis with extensive and voluminous lesions. We have a number of records at the experiment station of sleek, fat cattle, apparently in the best health at the time they were killed, which were found to be extensively tubercular on postmortem examination. One case was especially impressive and merits a reference to it here. It is the record of the best conditioned and fattest cow in a dairy herd of over 20 animals, a number of which were slaughtered after they had reacted to tuberculin. The cow was in prime beef condition; she had not shown a symptom of sickness within the memory of the persons interested in her; she reacted typically to the tuberculin test; her semblance of perfect health caused the expression of much doubt regarding the significance of the reaction, and on autopsy she was found to be the most extensively diseased animal among the nine or ten tubercular cows removed from the herd, some of which were very badly affected.

Cattle of this kind, a group to which No. 9 belongs, show that it is impossible to clean dairy herds of tubercular animals without the use of tuberculin. That animals like No. 9 are dangerous is shown positively by the fact that 2 of the 4 guinea pigs which received room exposure in her stall became affected with tuberculosis—that is to say,

this cow, fat, in excellent condition, and apparently in perfect health, was evidently more active in scattering tubercle bacilli than some of the other tubercular cows used in our experiments, notwithstanding that the latter were emaciated, weak, affected with a cough, and displayed many other evidences of disease.

Cows Nos. 10 and 11 require no special discussion. They were animals affected with generalized tuberculosis without lesions of the udder or structures adjacent to it. The several hogs that were fed milk obtained from the 2 cows did not become tubercular. The milk was drawn with considerable precautions, such as can not be practiced economically in dairy herds, to prevent its infection with tubercle bacilli from the exterior of the cows or their environment.

The tendency of the results obtained from our experiments is to point to the conclusion that the presence of tubercular cows in a dairy herd is a danger which affects not only the health of the persons who use the milk, but also the prosperity of the owner of the cattle, and consequently that it is necessary, both for moral and economical reasons, that our dairy herds should be made free from tubercular animals as soon as possible. No man can conscientiously sell infected milk when he has become acquainted with the harm it may do, and no man will voluntarily continue to expose his property to a danger the importance of which he has learned to know.

Too much stress can not be laid on the fact that tubercle bacilli are apparently more numerous in the environment of tubercular cattle than in their secretions from organs, like the udder, which have not become involved in the disease. Irrespective of the view that may be taken relative to the elimination of tubercle bacilli from the bodies of tubercular animals in their secretions from unaffected organs, it must be admitted that the chance for the introduction into these secretions, or into the secretions of healthy animals in the same environment, of infected material, such as particles of soiled forage or bedding, dust, masses of mucus which have adhered to the skin and hair, etc., is a very great danger, decidedly of too much importance to be ignored. The habit which cattle have of licking each other is sufficient to account for the occurrence of tubercle bacilli in the milk of a healthy cow into which some of her hair or scales of epidermis have fallen after she has been in contact with a cow affected with tuberculosis of the respiratory organs.

With these facts in mind and the knowledge that tuberculin is an almost unfailing agent for the diagnosis of tuberculosis, and that cattle are generally resistant to the form of infection to which they may be exposed through contact with tubercular human beings, very little excuse remains for the much longer existence of tuberculosis among either dairy cows or other cattle.

ENZYMES IN CORNSTALKS AND THEIR RELATION TO CORNSTALK DISEASE.

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The occurrence of substances which produce prussic acid in fodder plants was first noted by Dunstan and Henry.[1] [a] These investigators have shown that the poisonous effects produced by Egyptian vetch are due to prussic acid, which is not present in the plant as such, but is formed by the hydrolitic action of an enzyme (lotase) on a glucoside (lotusin). Shortly afterwards similar observations on American sorghum were reported by Peters and Slade.[2] These authors found that prussic acid appeared in watery extracts of sorghum which were allowed to stand at room temperature for some time. Similar extracts which were first boiled and then set aside remained free from that poison. As a result of these experiments they concluded that the formation of prussic acid in the unheated sample was due to the action of an enzyme upon a glucoside, but did not succeed in isolating either of these bodies. Subsequently Brunnich [3] carried out a number of experiments for the Queensland department of agriculture to ascertain at what periods and under what conditions of growth sorghum and related fodder plants are most apt to contain substances producing prussic acid, and therefore when most dangerous and when they may be eaten with impunity. Brunnich came to the conclusion that all fodder plants related to sorghum should be fed with care in either the green or dried state; that they should not be fed in large quantities to animals which have fasted for some time, and also that they should never be fed in a very immature stage of growth.

In the corn district in the Middle West of the United States the common practice is to remove the ears of corn from the standing stalks and turn cattle into the stalk field to gather the ears left by the huskers and to consume what they will of the roughage. Frequently within a day or two after turning the cattle into the field they suddenly sicken and die. This sickness is known as cornstalk disease, and the annual loss of stock from this cause amounts to thousands of dollars. This disease has attracted much attention, and many theories as to the cause have been advanced. None of them, however, has proven satisfactory in explaining all outbreaks of the disease.

[a] The figures refer to the bibliography at the end of this article.

This uncertainty in regard to the cause of cornstalk disease is no doubt due to the fact that many different maladies have been included under this name. Some of them are probably true infectious diseases, while others appear to be simple intoxications due to some poisonous substance present in the food.

The symptoms seen in many outbreaks of cornstalk disease correspond so closely to those that would be expected after poisoning by prussic acid that, in the light of the previously quoted investigations concerning prussic acid in sorghum, it was considered advisable to conduct similar examinations of cornstalks.

During the winter of 1903–04 a number of deaths among cattle, supposed to be due to eating cornstalks, were reported to this Bureau from the State of Iowa. A representative of the Bureau in that State was requested to send samples of cornstalks obtained from the fields where the deaths occurred. These stalks were chopped up at the laboratory and a number of samples, which were placed in flasks with water, chloroform being added to prevent bacterial growth, were placed in the incubator at a temperature of 38.5° C. for periods of time varying from one to seven days. The contents of the flasks were then filtered, the filtrate acidified, and distilled until the distillate measured 50 c. c. The distillate was tested for prussic acid by Schönbein's paper, which is made by taking ordinary filter paper and dipping it into an alcoholic solution of guiacum and then allowing the paper to dry. If this paper is then dipped into a weak solution of copper sulphate and exposed to prussic-acid fumes it will turn a deep blue. Neither by this test nor by the well-known Prussian-blue test could any trace of prussic acid be noticed. Some of the finely chopped stalks were then subjected to a chemical examination for the presence of a glucoside which could be decomposed into prussic acid by means of an enzyme, the method of procedure being as follows: Extract the finely powdered material with methyl alcohol for several days, filter and distil off the solvent. The residue was warmed with water until nothing more dissolved. To this solution an aqueous lead acetate solution was added until no further precipitation occurred. The precipitate was removed by filtration and the filtrate treated with hydrogen sulphide until all the lead was precipitated. The precipitate was separated by filtration and the greater part of the hydrogen sulphide was removed from the filtrate by allowing a stream of air to pass through it for two hours. The liquid was then treated with powdered charcoal, the mixture being evaporated *in vacuo* at 40° C. until dry, when it was extracted in a Soxhlet apparatus with anhydrous acetic ether. This solvent should remove any glucoside, leaving behind nearly all glucose and extractive matter. On evaporating off the solvent any glucosides that are present will be in the form of a sirupy residue and may crystallize if allowed to stand in a vacuum

over sulphuric acid for several days. Neither by means of this method nor by several other methods which were tried could any trace be obtained of a glucoside that would break up into prussic acid.

An examination was then made for enzymes. This was done by extracting some of the finely chopped stalks for several days with water saturated with chloroform. This extract was filtered and sufficient alcohol added to the filtrate to make a 60 per cent solution. The liquid was shaken for half an hour and set aside at room temperature for twenty-four hours, at which time an abundant flocculent precipitate had collected in the precipitating jar. The clear liquid was then siphoned off, the residue dissolved in water, and a solution of sodium phosphate and calcium chloride added until a heavy precipitate of calcium phosphate formed. This was allowed to settle, chloroform being added to prevent bacterial action. The clear liquid was again drawn off and the residue shaken up with water and filtered; this filtrate was dialyzed for twenty-four hours in running water; sufficient alcohol was then added to make an 80 per cent solution and the mixture shaken violently for half an hour. The precipitate was allowed to settle for twelve hours and then filtered off, the precipitate being washed with 95 per cent alcohol and dried. The powder thus obtained was of a light-brown color, soluble in water. The water solution was tested for enzymes as follows:

Oxydase.—To 5 c. c. of a 5 per cent solution of gum guiacum in alcohol was added, drop by drop, the solution to be tested, a boiled portion of the solution to be tested for enzyme being used as a check. No blue color was given by either the heated or unheated solution, showing the absence of oxydases.

Peroxydase.—To 5 c. c. of a gum guiacum solution a few drops of hydrogen peroxide were added and then drop by drop the solution to be tested. This gave a deep-blue color, indicating the presence of peroxydase, while some of the boiled solution when added to guiacum extract gave a brown color, showing that the peroxydase had been destroyed by boiling.

Catalase.—To 40 c. c. of a solution of cornstalk enzyme, containing 5 grams of enzyme powder to 100 c. c. of water, 5 c. c. of hydrogen peroxide solution was added, and the amount of oxygen given off was measured. In fifteen minutes 13½ c. c. of oxygen was given off. The check, which was a boiled solution of the enzyme, gave no oxygen when treated with hydrogen peroxide. This shows that the enzyme solution has the properties of catalase.

Protase.—A 10 per cent solution of gelatin in distilled water was prepared, thymol being added to prevent the interference of bacteria, and the solution was rendered slightly opaque by the addition of calcium carbonate. This was distributed in sterile tubes, approxi-

mately 5 c. c. in each tube, and cooled rapidly to prevent the calcium carbonate from settling. Five cubic centimeters of 0.5 per cent cornstalk enzyme solution, containing a few drops of toluol, was added to gelatin tubes, and these tubes set aside at room temperature for twelve hours. The gelatin had been acted upon, and at the end of twelve hours its height in the tubes had been lowered one-fourth of an inch. In the check, which contained some of the boiled enzyme solution, the gelatin had not been acted upon.

By acidifying a portion of the enzyme solution, so that it contained 0.27 per cent HCl, and by making another portion alkaline with sodium carbonate and then testing the action of these solutions on gelatin tubes, the acid solution was found to be the most active. These results indicate a proteolytic enzyme with properties similar to pepsin.

Diastase.—Five cubic centimeters of a 0.5 per cent solution of corn enzyme was added to a 1 per cent starch solution, toluol added, and the mixture set in the incubator at 38.5° C. for twenty-four hours. The solution was then tested for reducing carbohydrates by heating with Fehling's solution, with negative results. This shows that no diastatic enzyme was present.

Invertase.—Ten cubic centimeters of a 10 per cent cane-sugar solution was added to 5 c. c. of 0.5 per cent enzyme solution, some toluol added, and the solution examined with polariscope, then set aside at 38.5° C. for twelve hours, again tested with polariscope, which showed an inversion. A check containing boiled enzyme solution showed no inversion.

Lactase.—Ten cubic centimeters of 10 per cent lactose solution was added to 5 c. c. of 0.5 per cent enzyme solution, some toluol added, and the solution examined with polariscope, then set aside at 38.5° C. for twelve hours, again tested with polariscope, which showed no inversion, showing the absence of lactase.

Maltase.—A solution of maltose tested in the same manner as the cane sugar and lactose showed the absence of maltase.

Cytase.—By taking a thin section of a carrot and dissolving the starch by means of saliva, then staining the cellular membrane with methyl green and putting the section on a thin cover glass with a few drops of enzyme solution and examining by the ordinary hanging-drop method, the slide being maintained at 30° C., no action was noticed on the cellulose.

Lipase.—To 10 c. c. of ethyl butyrate solution was added 5 c. c. of cornstalk enzyme solution containing some toluol, this mixture set aside at 38.5° C. for twelve hours and the acidity determined, using litmus as indicator. The acidity was not increased. The enzyme solution was therefore lacking in ability to break up fats.

Glucoside-splitting action.—When the glucoside amygdalin is decomposed by the enzyme emulsin, both of which occur in bitter almonds, the glucoside breaks up by hydrolysis according to the following reaction:

$$C_{20}H_{27}NO_{11}+2H_2O=2C_6H_{12}O_6+HCN+C_6H_5CHO.$$

This property of amygdalin was utilized to determine whether the cornstalk enzyme possessed the power of producing prussic acid from that glucoside.

Ten cubic centimeters of a 0.5 per cent solution of enzyme from cornstalks containing some toluol was added to a solution of amygdalin in water, the mixture was set aside at room temperature, and at the end of half an hour tested for prussic acid. A strong odor of oil of bitter almonds was noticed and the solution gave strong reaction for prussic acid. A boiled sample of the enzyme solution showed no action on the amygdalin. These tests show that the cornstalks contained an enzyme similar to the emulsin enzyme of bitter almonds. To determine the difference between emulsin enzyme and the cornstalk enzyme, some emulsin was isolated from bitter almonds and tested according to the method used in testing the character of the cornstalk enzyme.[a]

	Bitter almond enzyme.	Cornstalk enzyme.
Oxydase	—	—
Peroxydase	—	+
Catalase	—	+
Protase	—	+
Diastase	—	—
Invertase	+	+
Lactase	+	–
Maltase	—	
Lipase	—	—
Cytase	—	—
Glucoside-splitting enzyme	+	+

The enzyme solution from cornstalk having shown the properties of several enzymes, it would indicate that we had a mixture to deal with rather than one enzyme with these various properties. The following method was used to determine whether or not the supposition was correct: Five cubic centimeters of a 0.5 per cent solution of cornstalk enzyme was put in each of ten test tubes and brought rapidly to the temperatures indicated below. On reaching these temperatures they were immediately cooled by the addition of some amygdalin solution and placed in the incubator for twelve hours, when they were tested for prussic acid, with the following results:

[a] The sign + indicates a positive reaction; the sign —, a negative reaction.

Tube No.—	Temperature.	Reaction.
	° C.	
1	60	+
2	62	+
3	64	+
4	66	+
5	68	+
6	70	+
7	72	+
8	74	+
9	76	+
10	78	−

A temperature of 78° C. destroys the glucoside-splitting action of the cornstalk enzyme.

Some more of the enzyme solution was heated in a similar manner, cooled immediately and tested for its proteolytic action.

Tube No.—	Temperature.	Reaction.
	° C.	
1	50	+
2	52	+
3	54	+
4	56	+
5	60	+
6	64	+
7	68	−
8	72	−
9	76	−
10	78	−

A temperature of 68° C. destroys the proteolytic action of cornstalk enzyme.

The temperature which destroyed the inverting action of the cornstalk enzyme was next determined.

Tube No.—	Temperature.	Reaction.
	° C.	
1	50	+
2	52	+
3	54	+
4	56	+
5	58	+
6	60	+
7	64	−
8	68	−
9	70	−
10	74	−

A temperature of 64° C. destroys the inverting action of cornstalk enzyme.

The emulsin enzyme of bitter almonds was heated and its destruction point noted.

Tube No.—	Temperature.	Reaction.
	° C.	
1	60	+
2	62	+
3	64	+
4	66	+
5	68	+
6	70	+
7	72	+
8	74	+
9	76	+
10	78	−

The glucoside-splitting property of emulsin enzyme from bitter almonds and that of the cornstalk enzyme were destroyed at the same temperature.

A physiological test was made with the cornstalk enzyme by feeding some to guinea pigs and rabbits in the following manner:

Guinea pig No. 1, fed 5 c. c. of 0.5 per cent enzyme solution plus 0.04 gram amygdalin.

Rabbit No. 1, fed 5 c. c. of 0.5 per cent enzyme solution plus 0.04 gram amygdalin.

Both of the above animals died within twelve hours.

Guinea pig No. 2, fed 5 c. c. of 0.5 per cent boiled enzyme solution plus 0.04 gram amygdalin.

Rabbit No. 2, fed 0.5 per cent boiled enzyme solution plus 0.04 gram amygdalin.

Neither guinea pig No. 2 nor rabbit No. 2 showed any ill effects as a result of the feeding.

Duplicates of these feeding experiments gave similar results. After having tested each sample of cornstalks that had been forwarded from the West and having found this emulsin-like enzyme present in large quantities in each sample, two samples of cornstalks that had been grown in Maryland were examined. One of these samples was obtained from the field before the corn was harvested and was quite green, while the other was obtained from a quantity of stalks that had been lofted the previous year. Both samples showed equally as large amounts of this enzyme as were found in the cornstalks from the Western States.

The presence in cornstalks of this enzyme, which has the property of decomposing amygdalin into prussic acid, and the absence of any glucoside in the stalks, which could be decomposed into prussic acid, leads us to believe that, if some cases of so-called cornstalk disease

are caused by prussic acid through the action of an enzyme upon a glucoside, the glucoside probably occurs only in certain stalks, and then only when the conditions are especially favorable for its development, or else that it is at times present in other field plants. It will be seen from some of the histories of characteristic cases of cornstalk disease given below that it is not unlikely that prussic-acid poisoning may be the cause of some cases of the disease; that other plants in the cornfield, or in other fields to which the animals had access either at the same time that they pastured in the cornfield or previously, could have furnished the glucoside necessary for the formation of prussic acid.

A case from Kansas, quoted from Bulletin No. 49 of the Kansas Agricultural Experiment Station, has been reported, where a farmer drove his cattle, numbering 12, from his pasture to the barnyard about 5 o'clock in the evening. The pasture was very dry and short, and, as the cattle were taken up earlier than usual, they were fed some cornstalks taken from the manger of a bull which was kept confined to the barn. The bull had not eaten the cornstalks clean, but what he had eaten had no ill effects on him. The remaining portion, estimated at about 4 armfuls, was fed to the cattle, which seemed to relish the stalks and ate them readily. Within eight hours 7 out of the 12 animals were dead. A farmer in Iowa, reported in Bulletin No. 10 of the Bureau of Animal Industry, states that he had 14 acres of corn on high land. The corn being good, he turned 24 cattle, mostly calves, 4 to 7 months old, into the stalk field on November 15. For several weeks prior to this they had been on clover pasture. For the first three days the cattle were allowed to remain in the stalk field for about three hours daily. They were allowed to run at will in a clover meadow adjoining the cornstalk field and appeared to do well for several days, when they began to die. Another case has been reported from Iowa (Bulletin No. 10, Bureau of Animal Industry), where 25 cattle, mostly yearlings, were turned into a 15-acre cornstalk field. For the first few days they were in the cornstalk field for a few hours only each day, but later they were left in the field continually. Rye had been sown in the cornfield, which gave a considerable amount of green food. In four days the animals began to die. These are only a few examples of numerous similar cases where animals had access to some pasture other than the cornstalks, while in all cases the stalk field contained a number of plants that the cattle ate besides the cornstalks.

The death of a portion of the animals goes to show that these probably ate some material which the others did not, or that they got the poisonous material in a larger quantity, as is illustrated by the case of sorghum poisoning, which occurs only in a portion of the animals

eating the sorghum; or it may be that some of the animals were more resistant to the action of the poison.

The discovery of the presence in cornstalks of an enzyme which has the property of forming prussic acid when acting on a proper medium, such as the glucoside amygdalin, was made so late in the fall that no work could be taken up leading to the detection of a glucoside in other plants to which the cattle had access. In order to approach this question as nearly as possible, however, some grains and plants used for cattle foods were tested for a glucoside which could be broken up into prussic acid, and also for the presence of a glucoside-splitting enzyme, with the following result:

Food.	Glucoside-splitting enzyme.	Glucoside.
Alfalfa (green)	−	−
Timothy (green)	−	−
Wheat (grain)	−	−
Corn (grain)	+	−
Linseed (grain)	+	+
Cotton seed:		
Pride of Georgia	+	−
King	+	−
Excelsior	+	−
Doughty	+	−
Culpepper	+	−
Sea-island	+	−
Sunflower	+	−
Staple	+	−
Truitt	+	−
Russell	+	−

Linseed was the only food material examined that contained both a glucoside and a glucoside-splitting enzyme. The amount of prussic acid formed after 25 grams of the ground linseed had stood in contact with 200 c. c. of water containing chloroform at 38.5° C. for twenty hours was determined by filtering the incubated extract and distilling off about 50 c. c., the distillate being collected in 20 c. c. of $\frac{N}{10}$ silver nitrate solution. The precipitate formed was found to be silver cyanide, which weighed 0.0055 gram, equivalent to 0.0011 gram of prussic acid, or 0.0196 gram of prussic acid for every pound of linseed. A sample of ground linseed-cake meal free of the oil was treated in the same manner and formed only one-half the amount of prussic acid as the whole seed, showing that probably some of the glucoside was broken up by the heat when the linseed was "cooked" before the oil was taken from it. The amount of prussic acid formed in linseed meal is too small to prove fatal in ordinary feeding, but

might prove so if the animal were allowed to obtain the meal in too large quantities.

These investigations, while not conclusive in regard to the relation prussic-acid poisoning bears to the so-called "cornstalk disease," have at least established that there is present in cornstalks an enzyme which has the property of decomposing amygdalin, and thereby producing prussic acid. In view of this fact, and also because the symptoms seen in many outbreaks of cornstalk disease resemble those which would be expected to follow prussic-acid poisoning, it seems not unlikely that at least some of the instances of so-called cornstalk disease may be due directly to prussic acid formed by the action of an enzyme upon a glucoside. As has been stated previously, no glucoside capable of furnishing prussic acid as a result of enzyme action was found by the writer in the comparatively small number of examinations made. When the great variety of plants found in ordinary fields, and also when the possible influence of physical conditions of the soil and atmosphere upon the physiological processes of the corn itself are considered, however, the failure to find a glucoside in a few samples of cornstalks does not prove that the glucoside may not exist in cornstalks under different conditions, or in plants other than corn. It is hoped that in the near future we shall be able to investigate more fully the question of the existence of an amygdalin-like glucoside in corn and other plants.

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BACILLUS NECROPHORUS AND ITS ECONOMIC IMPORTANCE.

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The bacillus of necrosis presents itself as an attractive study because of its ubiquitous character, its highly infectious nature, its extensive range of pathogenesis, the definite form of lesion produced by it, its easy demonstration in those lesions, and the difficulty with which it is isolated. Its interesting character, its economic importance, and the scant literature in English concerning it are the reasons for this study of it.

SYNONYMY.

The following names have been applied to this microorganism: *Bacillus der Kälberdiphtherie* (Löffler), 1884; *Bacillus diphtheriæ vitulorum* (Löffler), 1886; *Bacillus necrophorus* (Flügge), 1886; *Bacillus filiformis* (Schütz), 1887; *Nekrosebacillus* (Bang), 1890; *Streptothrix cuniculi* (Schmorl), 1891; *Actinomyces cuniculi* (Gasperini), 1892; *Bacillus necroseos* (Salomonsen), 1894; *Bacillus des Kälbernoma* (Ritter), 1895; and *Streptothrix necrophora* (Kitt), 1899.

The most careful scrutiny by us of all phases of its morphology having thus far failed to reveal true branching in the necrosis bacillus, we are compelled to regard it as belonging to the Bacteriaceæ and to acknowledge Flügge's priority by calling it *Bacillus necrophorus.*[a]

HISTORY.

To Löffler belongs the credit of discovering, describing, and demonstrating the necrosis bacillus in its relation to the pathologic process whose name it bears. Yet the names of two, and possibly of three, observers may be mentioned by way of introduction.

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[a] Lignières and Spitz[20] (see bibliography, p. 113), in their recently published classification of the Actinomyces, confirm our position by removing from the group of Streptothrix and of Actinomyces " microbes like the bacillus of necrosis (improperly *Streptothrix cuniculi*), which do not belong at all to this group."

Dammann [4] [a] was probably the first to see, Koch the first to note, and Löffler the first to investigate this microorganism. In November, 1876, Dammann published the results of his investigations of a caseonecrotic inflammation of the mouth, throat, and upper air passages of some sucking calves on a farm in Ludwigsburg, on the shores of the Baltic. The macroscopic lesions closely simulated those found in diphtheria of man; and, since the microscopic examination of those lesions showed the superficial layers crowded with micrococci, which organisms were recovered in great numbers from the blood of the heart of the dead calves and from rabbits inoculated with bits of the diseased tissue, accepting the then prevailing dictum of Eberth, "without micrococci no diphtheria," Dammann pronounced the disease in question diphtheria of calves and regarded it as identical with the disease of the same name in man. However, there can be no doubt that Dammann saw, but failed to recognize, the real cause of the disease in question. On page 12 of his paper, after having described the superficial layers of the pseudomembranous deposits as composed largely of heaps of micrococci, he refers to the middle and deeper layers containing a thick network of fine fibrin threads. His further delineation of these thread forms compels the impression that he was describing the filaments of *B. necrophorus*. Unfortunately, in spite of his carefully reported clinical and postmortem findings, Dammann's work on calf diphtheria can not be safely resorted to for an exact description of the effects of the necrosis bacillus, for the reason that in all his cases he had to do, beyond question, with a complicating septicemia, the result of a virulent micrococcus infection.

It is not without interest to note that in 1878 Feldmann reported a case of diphtheritis in a calf, described symptoms analogous to those in the Dammann calves, and regarded the cases identical. His bacteriologic examination revealed "kugel-und rosenkranzförmige bakterien." While it is true that "rozenkranzförmig" is used in bacteriologic parlance to denote the wavy chains of streptococci, still one who has examined the diseased tissues in necrotic stomatitis in calves will very likely be disposed to translate "spherical and beaded bacteria" and recall how often the beaded necrosis bacillus resembles the undulating chains of streptococci.

Koch, in his work "Zur Untersuchungen der pathogenen Organismen," introduces two microphotographs (Nos. 47 and 48) as "sections from the cornea of a case of sheeppox showing the border of the corneal layer. The ulcerated spot is surrounded by a large nuclear accumulation, and between the nuclei there is diffused a thick felt of bent bacilli, slightly curved, sometimes undulating. At many

[a] The figures refer to the bibliography at the end of this article.

points the bacillary masses advance in front of the nuclei in the still intact corneal tissue, as on No. 47. It is on that account also probable that the ulceration is limited by the immigration of the bacilli. Here and there the bacilli have a granulated appearance—No. 48."

In 1884 Löffler published the results of his now monumental work in diphtheria. In this connection he investigated the so-called "calf diphtheria" of Dammann. On the edges of the caseonecrotic patches Löffler discovered great bundles of *B. necrophorus* and succeeded in conclusively proving their causative relation to the disease in question, on which account he speaks of it as the bacillus of calf diphtheria. In his report Löffler, having noticed the above statement by Koch, says:

They [the bacilli depicted by Koch] simulate so completely in structure, size, and arrangement those found by me in calf diphtheria that one may be inclined to consider them identical.

And C. O. Jensen, who has, with Bang, made extensive studies with the necrosis bacillus, says of these same Koch bacilli:

welche so grosse Aehnlichkeit mit Nekrosebazillen darbieten das ihre Identität mit diesem wohl-keinen Zweifel erleiden kann.

Löffler in his report refers to Dammann's success in transmitting the disease from calves to lambs, and states, furthermore, that there occurs among lambs an exceedingly pernicious diphtheria, which, according to the description, bears a great resemblance to that of calves. Querying if the two diseases might not own the same etiologic agent, he quotes Koch's above-mentioned observation to show that a practically identical microorganism does grow in the body of the sheep.

That he did not assert the identity of the two microorganisms is seen by his next paragraph:

In experiments looking to the transmission of syphilitic products to rabbits I learned to recognize still a third form of bacillus, which morphologically was very similar to that of calf diphtheria.

Then follows the account of a very marked caseonecrotic process, followed by death, induced by these experiments, in which the pathologic picture and bacteriologic factor presented a striking likeness to those of calf diphtheria inoculations.

The effect of this lack of absolute certainty as to the identity of these microbes is seen in the synonymy. In 1886 Flügge describes *Bacillus diphtheriæ vitulorum* as the bacillus of calf diphtheria and *Bacillus necrophorus* as the organism responsible for the caseous necrosis produced by inoculating bits of broad condyloma into the anterior chamber of the eye of rabbits.

In 1887 Bang and Schütz investigated conjointly a severe epidemic of hog cholera in Denmark which was known there largely as swine

diphtheria. Bang, finding that he could kill hogs by feeding pure cultures of the short, ovoid, and motile bacillus discovered by him in the tissues of diseased hogs, attributed also to this bacillus the cheesy necrosis—so-called diphtheritic patches—which appeared to be such a marked characteristics of this disease. On the other hand, Schütz [35] found in the caseous inflammations of the intestines long thread-shaped bacilli which he named *Bacillus filiformis*. He considered the deeply penetrating intestinal necrosis, which he named diphtheritis profunda, analogous to the tissue alterations induced in the mouth by the calf diphtheria germ and expressed the supposition that his *B. filiformis* was identical with that microorganism and was the cause of all the caseonecrotic lesions occurring in hog cholera.

In 1888, Schütz refers to finding similar bacillary forms as the cause of abscesses frequently occurring in the liver of cattle. He performed on rabbits inoculation experiments similar to those undertaken by Löffler, and with like results.

In 1889, Th. Smith [39] reported that—

> In sections of ulcers hog cholera bacilli have been searched for, but the examination of a large number of ulcers showed that no positive results could be obtained. Different ulcers showed different bacteria, sometimes large colonies of micrococci, *sometimes groups of large bacilli, following the course of the blood vessels in the embryonic tissue under the slough.* These no doubt found their way in from the superficial slough which seemed to be made up almost entirely of bacteria.

The italicized portion of Smith's statement is quoted by Jensen in support of the latter's assertion that Smith had seen and described in the intestinal necroses of hog cholera bacillary forms that were identical with *B. necrophorus*.

It remained for Bang to establish the identity of Löffler's two bacteria, Schütz's *B. filiformis*, and the long bacilli of Smith. This he did as the result of a series of observations and experiments reported in 1890. Moreover, by these experiments Bang not only demonstrated the wide scope of its pathogenic influence, as including calves and adult cattle, horses, and hogs among the domestic animals and kangaroos among wild animals, though in a state of captivity, but also recognized the essential feature of its action as a local cheesy necrosis frequently followed by embolic necroses. He therefore gave it the name of Nekrosebazillus, or necrosis bacillus, which idea, however, had been already adopted in Flügge's appellation of *B. necrophorus*.

Acting upon Schütz's hypothesis above mentioned, Bang [13] inoculated mice and rabbits with material from necrotic foci in the intestines of hogs affected with hog cholera and obtained the same lesions at the inoculation point and in the internal organs as those observed

and discovered by Löffler in his calf diphtheria experiments. Thus was verified the suggestion offered by Schütz in 1887.

In 1891 Schmorl reported a most fatal enzootic occurring the previous year among his laboratory rabbits. From the caseonecrotic lesions of those dying he isolated a thread bacterium which, morphologically and biologically, he quite thoroughly studied. Although he named it (believing that he recognized branching) *Streptothrix cuniculi*, it has been identified with *B. necrophorus.*

Through the observations of McFadyean, Kitt, Olt, Jensen, Johne and Schlegel, Horne, and others, the list of animals susceptible to the morbid influence of the necrosis bacillus has been enlarged until it includes aves as well as mammalia; not only domestic animals, but also wild animals, both free and in captivity.

For the determination of the morphologic and biologic characters of the bacillus of necrosis attention is called chiefly to Bang,[1] Schmorl,[38] and Ernst.[10]

OCCURRENCE IN NATURE.

There is hardly room to doubt that *B. necrophorus* is a normal inhabitant of the healthy intestine of at least one species of our domestic animals—hogs—and possibly of the cow and horse. It is also found in the manure, and therefore in soil contaminated with the latter. Bang's discovery of the association of the organism with the necrotic processes in the intestine in hog cholera, and also as cause of an intestinal diphtheritis in calves secondary to an intestinal catarrh, seemed to require the intestine as the normal habitat of *B. necrophorus.* Could this be demonstrated we should then have an explanation of the remarkably ubiquitous character of the organism as exhibited in the wide diversity of diseases caused by it. In this manner could be explained its relation not only to the necrotic inflammations occurring in the vagina and uterus, but also to all the external necrotic processes. This Bang succeeded in doing. He twice made inoculations of the intestinal contents of healthy hogs with the result of demonstrating the presence of *B. necrophorus.* An analogous investigation by him of the intestinal canal of a cow was not so successful.

MORPHOLOGY.

B. necrophorus is essentially a pleomorphic organism. It varies, according to nutrient soil and age of culture, from coccoid forms to filaments over 100 μ in length and from 0.75 μ to 1.5 μ in width. The longer forms appear as slender, undulating, beaded filaments. Generally, in the tissues these threads are matted together into an intricate network, like a mass of hair or even more compact felt. The

same appearance may be found in colonies. Frequently the filamentous forms present one wide or clubbed extremity, with the other extremity tapering. On the other hand, the older cultures—either animal tissues or artificial media—exhibit almost exclusively bacillary forms of various lengths, some so short as to be easily mistaken for cocci. Involution forms may be present in any culture, but certain media, notably that composed of a mixture of agar, gelatin, bouillon, peptone, and salt are particularly favorable to their development.

MOTILITY.

Motion has not been observed in our experiments; in fact, it has been reported by Schmorl only. He examined the pleural exudate in hanging drop.

In this laboratory the examination for motility was made with fresh cultures and with tissue from animals within one hour after death, both by means of hanging drop and by the application of flagella stains. In no case was it possible to claim motion for these bacilli.

STAINING.

The necrosis bacillus stains readily with the ordinary anilin dyes, Löffler's methylene blue, and Ziehl's carbol fuchsin, producing particularly good effects. Alkaline toluidin blue (1 per cent solution), while not giving the brilliant effects of fuchsin, makes perhaps the best reagent for routine use. The slide, or cover slip, dipped in the stain, immediately washed in water and mounted, is a very rapid and satisfactory method of bringing out the beaded appearance of the organism. It does not take Gram's stain.

In the study of fresh tissue smears, it is usually sufficient to make a film on a slide with a teased particle of the suspected tissue, and after the usual preliminaries stain with one of the ordinary dyes mentioned, preferably methylene blue or toluidin blue. Whenever it was desired to employ differential staining, we found the following procedure to answer all requirements: The stains are kept ready for use in wide-mouthed bottles. Prepare the film on the slide in the usual manner, fix in the flame, dip from two to five seconds in a 1 per cent alkaline toluidin blue, wash thoroughly in water, counterstain in a 0.2 per cent Neisser's Vesuvian brown, finally wash in water, dry, and then mount in balsam.

Mention has been made of the beaded appearance of *B. necrophorus* in stained preparations. This is noticeable equally in tissue smears or sections and in films from cultures. The longer rods and threads particularly exhibit this characteristic. It is due to the occurrence

in the filaments of unstained spaces which were at first thought to be spores. Spore-staining methods, however, do not alter them. Careful study of this peculiarity reveals several phases of it. Sometimes a thread will be most regularly marked off into alternate sections of stained and unstained material; again, decided irregularity characterizes the arrangement—long vacuole-like inclusions alternating with shorter stained squares or bacillus-like spaces of stained material may alternate with shorter colorless portions; again, the vacuoles may appear like a chain of colorless rods lying on a ribbon of blue or whatever color may be used for the stain. Sometimes the stained material is so little in quantity that the thread seems like a string of spores, oval or rod shaped, with thin, deeply stained partitions between them. On the other hand, the filament presents itself as an unstained tube with a regular succession of deeply stained coccus-like granules much resembling streptococci, or these granules may be alternately arranged along the sides of the tube.

BIOLOGY.

Cultivation of *B. necrophorus* is not easy. It is an absolute anærobe. Investigators differ concerning its requirements as to temperature. Nocard and Leclainche give 30° to 40° C. as the limits of growth, with the optimum at 37° C.; Jensen adopts the same extremes, but places the optimum at 34° C.; whereas, according to Ernst, development occurs only between 36° and 40° C., and the optimum is 39° C. Our own investigations have shown that 30° to 40° C. represent the extremes of temperature at which the ordinary work of the laboratory may be satisfactorily carried on; nevertheless, we have on different occasions been able at 28° C. to grow in agar-bouillon shakes typical colonies, which responded to the usual tests of morphology, odor, and pathogenesis. With us the optimum was 35° C.

The usual culture media of the laboratory are either unsatisfactory for the development of the necrosis bacillus or altogether inimical to it. Agar-agar was often employed with only passable results, but more satisfaction was obtained from the following combinations: Agar-bouillon (A–B), agar-gelatin (A–G), serum-agar (S–A), serum-agar-gelatin (S–A–G), and two suggested by Ernst—1.5 per cent agar in a peptone-salt-bouillon (A–B–P–S) and 0.7 per cent agar and 7 per cent gelatin in bouillon with 5 per cent peptone and 2.5 per cent salt (A–G–B–P–S). The first four mixtures were usually prepared in the proportions of equal parts, although other proportions were adopted for the purpose of varying the consistency of the medium. Fluid blood serum, milk, rabbit bouillon, and Martin's bouillon were also employed.

PLATE CULTURES.

Bouillon-agar.—Great difficulty was experienced in getting the organism to develop colonies in Petri dishes. Numerous attempts were made by displacing air with hydrogen in a hydrogen jar, and by the formation of a vacuum by withdrawing the air under a bell jar by means of a vacuum pump, but success was not attained in any instance. Recently it was endeavored to grow the organism in Petri dishes placed in a closed jar containing a solution of pyrogallic acid rendered alkaline by sodium hydrate. This method, which permitted the presence of only the inert nitrogen gas, finally resulted in characteristic colonies occurring throughout the medium with the formation of numerous gas bubbles. Several of these colonies in the dish of the second dilution grew so close to the surface that some filaments extended to the upper stratum and could be removed by means of a platinum needle. In about forty-eight hours after exposing the plates to this method, small, pinhead-sized, dirty-white, opaque, round colonies, possessing no distinctive features, were visible to the unaided eye below the surface. Many small round or oval gas bubbles could also be observed. By means of a small magnifying glass these colonies were seen to possess a yellowish-brown center surrounded by a thin, light, almost translucent border, which, under the microscope, appeared floccose. After three days the colony presented to the naked eye a woolly appearance, and the microscope now revealed the central structure as a felted maze of threads and the floccose character of the border as long, wavy filaments.

SHAKE CULTURES.

Agar-bouillon.—In eighteen to twenty-four hours after inoculating a tube either from necrosed tissue or from a colony in another tube, or with a loopful from the depths of a pure Martin's bouillon culture, the tube is studded with small oval gas bubbles. At this time, also, rarely with the A–B medium, frequently with the softer forms, as S–A–G, A–G (2:1), A–B–P–S, and A–G–B–P–S, the column of culture medium will be transversely ruptured in one, two, or more places by the pressure of the gas. In forty-eight hours these sections will often be separated 2 to 5 mm. and even more from each other. We have sometimes seen this gas formation go on for the next two days energetically enough to raise the upper portion of the medium 2 cm. The dilution from the above-described tube—tube 2—would often follow tube 1 quite closely in the quantity of gas bubbles formed, though not in the breaking up of the medium. Tubes 3 and 4 would usually show a great diminution in the quantity of gas bubbles and no breaking up of the medium.

In the development of the growth our experience tallied quite closely in a few notable points with that of Ernst. For instance, shakes sown with necrosed material would often show, after thirty-six to forty-eight hours, a fine grayish-white mist of cloudiness at the lower portion of the tube. In our experience, even with slight magnification, it was possible to detect no particular structure. A film made from this portion of the culture medium would always show beaded forms. Again, when the medium used was jelly-like in consistency, the unabsorbed gas, instead of remaining as bubbles at the point formed, would gradually float upward toward the surface. The original seats of these bubbles and the pathways along which they had risen would be coated with a fine bacterial growth. Thus would be formed numerous filmy ribbons, extending from near the surface down into the depths of the tube, where they would be anchored by a crescent-shaped body. The time and rate of growth and appearance of colonies in the tube are sufficiently described in the above description of plates.

STAB CULTURES.

Agar-agar.—Near the close of the second day a few grayish-white colonies make their appearance at the bottom of the needle track. Gradually these increase from below upward to within 1–1.5 cm. of the top of the stab canal. Thus is formed a thin, narrow, opaque, yellowish or grayish-white line of growth surrounded by a thin whitish cloud, which on slight magnification is seen to be composed of minute wavy threads.

Serum-agar.—Time and height of bacterial growth and gas formation are like the preceding. At times the needle track is the center of a whitish film or merely a thin line of cloudiness of the medium; again, the growth may be denser, similar to that described for agar-agar. The serum is never liquefied, although in very old cultures it will be natural that the zone of cloudiness referred to will have spread nearly to the walls of the tube.

CULTURES IN FLUID MEDIA.

Bouillon.—The organism can be grown in ordinary peptonized beef broth, rabbit bouillon, and in Martin's broth, the maximum development occurring at the temperature of 35° C. in a hydrogen jar. The bouillon becomes turbid with the formation of some gas, which is noticeable by the surface bubbles. Later the bacillary masses sink to the bottom in the form of whitish, viscid flakes, causing the fluid to become clearer. The cultures have a peculiar odor, very characteristic, which will be referred to later. There is no film formation, but a tendency to develop a ring around the border of the medium has been observed.

ACTION OF GERMICIDES.

In determining the germicidal power of disinfectants a measured volume of a forty-eight hour bouillon culture of the necrosis bacillus was intimately mixed with an equal volume of the disinfecting solution, thereby reducing the strength of the germicide to one-half. Three platinum-wire loopfuls were then transferred to fresh rabbit bouillon tubes after varying periods of exposure. After an exposure of one minute in a 2 per cent solution of carbolic acid the bouillon tubes showed growth, but in the tube representing a two-minute exposure no development occurred. With bichloride of mercury an exposure of 9 minutes to a $\frac{1}{2000}$ solution prevented growth. Formalin in the strength of $2\frac{1}{2}$ per cent solution (1 per cent formaldehyde) killed the organism in thirteen minutes.

CHEMICAL ACTIVITIES.

PIGMENT PRODUCTION.

Chromogenesis is wanting.

ODOR PRODUCTION.

All cultures develop a substance or substances which emit an odor well described by Ernst as between the odor of cheese and that of glue. The stench is so characteristic that the presence of the bacillus is recognized at once in the tissues of either natural or experimental infection as well as in cultures on artificial media.

PRODUCTION OF SUBSTANCES THAT LIQUEFY.

Gelatin is not liquefied. The growth of the bacillus is likewise without effect on blood serum.

INDOL FORMATION.

Indol is formed and may be demonstrated in three-day-old cultures made in Martin's bouillon.

PRODUCTION OF CURDLING FERMENTS.

Milk is not coagulated nor is acid produced. Fluid serum is coagulated.

PRODUCTION OF TOXINS.

That the necrosis bacillus produces a toxin is evidenced, not by the isolation of the same from artificial cultures, but by (1) the character of death in the disease, (2) the quality of the rigor mortis, and (3) the study of the pathologic histology.

The toxic character of death is not particularly noticed in animals suffering from stomatitis when inappetency and inability to take nourishment have produced an enfeebled condition. Nor, again, is it noticeable in those animals which die with embolic foci in liver or lungs, the symptoms arising from the diseased organs often masking the signs of intoxication. However, rabbits inoculated subcutaneously in the back will persist, without any other sign of the disease except the abscess, for about five or six days. Suddenly, on the sixth or seventh day, without any premonitory signs, the rabbit will be thrown into convulsions, coming out of one to lie with its head turned sideways and buried in the bottom of the cage until another attack, dying usually in a few hours after the first convulsion. Quite often in these cases the local lesions will not be sufficient to produce death directly, not being very extensive and not involving any important organ. Such a course as this points unmistakably to a toxinemia which has attacked the nervous system.

The limits of this article do not permit a discussion of the factors entering into the production of cadaveric rigidity. For our present purpose it is sufficient to call attention to the fact that the intensity and long duration of the rigor mortis observed in the experiment animals and described later in this paper comports perfectly with the well-known fact that the presence of toxins in the blood promotes muscular rigidity.

It may be stated with positiveness that *B. necrophorus* does not enter an unimpaired tissue. Most, if not all, of its infections with which we are acquainted require for their inception a break in the continuity either of mucous membrane or skin. A histologic study of an affected area, elsewhere examined in greater detail, reveals a center of completely destroyed tissue marked by an entire absence of the specific bacteria in question. The boundary of this dead area is formed by great bundles of filaments of *B. necrophorus*, large numbers of leucocytes, and a fair sprinkling of tissue cells whose nuclei still respond to stains. The immediately adjoining border of surrounding healthy tissue is seen when carefully examined to possess numerous cells whose protoplasm has been more or less destroyed, and in among these dying cells a few scattered filaments have advanced like skirmishing parties before the main army. It is a true picture of a bacillary invasion of tissue begun by means of the noxious effects of a soluble toxin.

Thus far all attempts to recover the toxic substance either from cultures or the bacilli themselves have failed. From this, Jensen, whose assistant, L. Bahr, has made the only experiments thus far recorded, assumes that either the necrosis bacillus forms these substances only in the living animal or they are of such volatile character that they are destroyed as quickly as they are formed.

IMMUNITY.

The literature on *B. necrophorus* has contained no word on acquired immunity until the article by C. O. Jensen referred to above. This eminent investigator and early worker with the necrosis bacillus states that his assistant, Bahr, has demonstrated by experiments not yet published that intravenous injections of cultures of *B. necrophorus* carefully given to goats protect them from quite large quantities of the same given subcutaneously. Jensen further states that Bahr has produced in the same manner an immunity in guinea pigs from intraperitoneal injections. In view of the fact that most investigators pronounce the guinea pig almost if not absolutely immune, the statement needs further elucidation. On the contrary, while we are not willing yet to build any hypothesis upon it, we find that our reinoculation experiments have given us the impression that susceptibility is increased thereby rather than diminished.

PATHOGENIC CHARACTERISTICS.

Under this head we may view the disease-producing power of *B. necrophorus* in four directions. We may consider, first, the character of its pathogenic action—in other words, its general pathology; secondly, the animals susceptible to its morbific influence—its comparative pathology; thirdly, its special pathology, or the different tissues of the animal body which may be affected by its destructive properties; and, fourthly, its experimental pathology, which exhibits those peculiar results, after inoculation in laboratory animals, which form as definite and certain ground of diagnosis as inoculation of culture media or microscopic examination.

GENERAL PATHOLOGY.

This may be broadly stated as a coagulation necrosis with subsequent caseation, characterized by a most malignant tendency to involve the whole organism. This is manifested in three ways—by a progressive advance into the surrounding (especially the deeper) tissues, by an invasion of distant parts of the body by embolic metastasis, and, finally, by general intoxication.

PATHOLOGIC ANATOMY.

The local lesion, primary or secondary, may be described as a sharply circumscribed patch of yellowish or dull brown, sometimes greenish-white, homogeneous, structureless, dry, crumbly tissue débris of soft, cheesy consistency, resembling compressed yeast, and manifesting a characteristic stench that might be described as a com-

pound of the odors of old cheese and glue. The line of demarcation between the living tissue and the dead mass is a narrow hyperemic zone.

PATHOLOGIC HISTOLOGY.

Microscopic examination of the process in its various manifestations reveals always the same picture. It is composed of three zones. The central zone or area of necrosis contains the structureless remains of nuclear and tissue degeneration which show no staining reaction. The periphery of the necrotic area, as brought out by stains, reveals a salient border made up of bundled bacillary filaments mingled with round cells and leucocytes, whereas the central zone contains few or no bacilli. Between the border and the living tissue is a narrow, poorly stained ribbon of necrotic tissue showing but few bacilli.

PATHOLOGIC PHYSIOLOGY.

Necrobacillosis is always an inoculation disease—that is to say, the necrosis bacillus requires for its entrance into the body an impaired tissue; for the skin necrosis, any of the many likely breaks in the cutaneous surface, pressure of harness, burns, sores of any kind; for the hoof necrosis, tread, punctured wounds, suppurating corns, etc.; for necrotic stomatitis, eruption or shedding of teeth, penetration of the mucous membrane by a sharp-pointed particle of food; for necrosis of the genital tract, even the slight abrasions of the mucous membrane common in normal, easy labor, may become the means of infection. At the point of entrance the system recognizes the presence and multiplication of the bacilli by a reaction marked by congestion and reddening, followed by an exudation rich in albuminoids or fibrin-forming substances, and a defensive immigration of leucocytes.

The metabolic products of the bacilli are exceedingly poisonous, killing everything with which they come in contact. Hence the first effect of the organism is a necrosis, or death, of the superficial layer of tissue cells and leucocytes at the seat of invasion. The cells either suffer fragmentation of their nuclei or become transformed into irregular flaky masses—the so-called hyaline masses. This constitutes superficial erosion of the tissue. The process never stops here, though we may often recognize this stage in numerous recent foci of necrosis in a rapidly spreading form of the disease.

The second alteration is the production of false membrane by a combination of coincident changes. On the one hand, the necrosed tissue elements, having lost their nuclei and finer structure, are deprived of their normal granulation and striation and take on a scaly appearance, being converted into hyaline substance; on the other

hand, the albuminous exudate in which these dead cells are bathed precipitates fibrin or coagulates into fine threads. This is known as coagulation necrosis. There is thus formed a false membrane, the result of coagulation necrosis of the inflammatory exudate and the entanglement in its meshes of the hyaline degenerated tissue cells and leucocytes. This gives a grayish compact mass, more or less adherent to the underlying tissue which, by failure of the dead cells to be thrown off, may be built up an eighth of an inch or so.

The third alteration connected with this process is due to an invasion of the deeper tissues. The bacilli are always found on the border line between the living and dead tissue. Here, in great bundles of beaded filaments, they may be seen attacking the healthy tissue, which in turn has erected against the attack a wall of leucocytes, while masses of micrococci, tangles of streptococci, and clumps of bacteria are lodged in the superficial layers. Thus the process is carried down into the deeper tissues, forming ulcers and fistulous tracts of varying depth. By the coagulation necrosis occurring in the region of the blood vessels they become obstructed by pressure or sometimes by thrombosis, and thus the dead tissue becomes avascular, and the necrotic mass undergoes pulverization into finer and minuter particles until it is a dry, crumbly, yellowish mass of tissue detritus resembling cheese.

COMPARATIVE PATHOLOGY.

A brief survey of this field forms an interesting portion of the study of *B. necrophorus* and should prove convenient for reference. Extensive as are the present known boundaries of this field, there can be no question as to further clinical observation including additional forms within the range of the pathogenesis of this bacillus. In fact, since this statement was first penned there have come to our hand two additional species—one a European kite, or glede (*Milvus ictinus*), brought to this laboratory for necropsy; the other the common guinea pig, two animals being sent alive to us from the National Zoological Park. The necropsy of the kite revealed the lesions of avian diphtheria and the necrosis bacillus in great abundance. The two guinea pigs were suffering with submaxillary abscess, identical in origin. The pus from each abscess contained masses of beaded filaments in association with a micrococcus. The filaments isolated from each species responded fully to all the required tests. The animals affected under natural conditions are, as thus far reported, cattle, sheep, goats, antelope, reindeer, red deer, roe deer, horses, asses, hogs, kangaroos, rabbits, dogs, chickens, kite, and guinea pigs. Experimental work has added to the foregoing list mice and pigeons.

SPECIAL PATHOLOGY.

Lodgment in the tissues of the body of a susceptible animal is all *B. necrophorus* requires. Once this is secured where it may develop and throw out its deadly, volatile toxin, all tissues with which it comes in contact become alike a prey to its necrosing action. In spite of numerous overlappings we shall be able to consider this subject in the following order: Necroses of the skin, muscle, hoof, cartilage, bone, mucous membranes (mouth and upper air passages, digestive tract, genital tract), navel, and viscera.

NECROBACILLOSIS OF THE SKIN.

The inflammatory diseases of the skin may for our purposes be classified as (1) erythema, or simple redness of the skin; (2) the eczemas, which may be arranged in five stages—(*a*) the erythematous, (*b*) papular, (*c*) vesicular, (*d*) pustular, (*e*) squamous, this last often passing into a chronic state and giving rise sometimes to the verrucous, or warty, variety; (3) necrotic or gangrenous dermatitis.

Necrotic dermatitis.—Necrotic inflammation of the skin, dermatitis gangrænosa, Haut-brand, or Haut-nekrose of the Germans, are the titles of a group of destructive inflammations of the skin arising from various causes, such as burning, freezing, slight cauterization, trauma, blows, pressure of harness, etc., decubital disease processes in the skin during general infections, embolism, thrombosis, as also from specific infections of the skin. Under this last etiologic factor occur those lesions of the skin caused by the presence of *B. necrophorus*.

Fröhner [11] observed an enzootic of this disease on a large horse farm in Berlin. The affection took the form of multiple necrosis of the skin, the portions implicated being those spots exposed to irritation by the harness, especially the shoulder and sacral regions, the cheeks, and the corners of the mouth. The infection was of a quite malignant character, showing a tendency, in spite of the ordinary antiseptics, to spread and involve the deeper tissues. The necrotic lesions were characterized by the presence of a grayish-yellow, greasy, foul-smelling secretion. In one case the affection began at the left corner of the mouth following injury by the pressure of the head harness. In spite of the application of formalin, the necrosis spread until the entire left side of the head was swollen, with new foci of necrosis making their appearance. Energetic disinfection with creolin water and application of tincture of iodine was always the treatment that succeeded after the milder applications failed. Fröhner considers *B. necrophorus* to have been the infectious agent, operating secondarily at the sites of pressure irritation.

W. R. Davis [6] recognized the connection between very low temperatures and the development of gangrenous dermatitis, admitting the

possibility of the tissues that have been damaged by the effect of cold being invaded by the "ever-present bacillus of necrosis." The cases cited by him, with one death, were affected by working in irritating mud and then at night having the hose turned on the legs and allowed to dry in a cold, drafty stable. As indicative of infection, he emphasizes the intensity of the inflammatory process, the rapidity with which the changes were produced, and the general symptoms—inappetence, rapid and feeble pulse, shivering, high temperature, great depression and weakness, suggesting intoxication. Cases reported by this author [5] in 1897 have a close resemblance to those in his later report, all being included in the form of dermatitis described in the next paragraph.

Necrotic scratches.—Scratches in the horse is essentially a dermatitis, or inflammation of the skin, of that region of the foot known as the fold of the pastern. The affection is also popularly spoken of as grease, greasy heels, etc. Four varieties of scratches may be described, as follows:

(1) An erythematous form, or simple reddening or erythema of the skin.

(2) An eczematous variety, characterized by swelling, reddening, and an exudation. This is the variety most often noticed, and, on account of the exudation, the one that gives rise to the name "grease," or "greasy heels." The erythema, perhaps, frequently occurs without attracting any attention. The dermatitis eczematosa is usually noticed on account of the lameness on beginning to move. If the animal is not allowed to rest, the combined effect of activity and dirt is seen in the further course of the disease in the production of cracks and fissures. There can be no doubt in these cases as to the frequent presence of some infection superadded to the primary causes of irritation, such as sand, dirt, and even chemical irritants.

(3) A third variety of scratches is that which constitutes what is commonly known as grapes. It is the so-called verrucous scratches. This arises as a consequence of the preceding variety having gone on to the squamous stage and assumed a warty appearance, due to the hypertrophy of the papillæ.

(4) The fourth variety of scratches, dermatitis gangrænosa, gangrenous, or necrotic scratches, gangrenous grease, called "Brandmauke" by the Germans, has been shown by Bang, Hell,[15] and others to own a specific cause. Commencing as a mere erythema, by lack of rest and from further exposure to the original causal influences, the affection takes on the eczematous character. In the abraded surface, coated with a greasy exudate, by mixing with which the dirt has made an air-tight packing, *B. necrophorus* finds an attractive nidus, whence it institutes its caseonecrotic process, which is always marked by a progressive character. In the progress of this destructive in-

flammation not only the skin is affected, but the subcutaneous tissue is also involved. It quite often penetrates into the tendon sheath of the flexor apparatus, causing its necrosis. The necrosis may travel upward as far as the back, involving the subcutaneous structures in that region, or it may burrow downward into the hoof structures, attacking not only the soft parts of the hoof, but also the lateral cartilages and the coffinbone. Recognizing manure and manure-contaminated soil as a secondary and frequent habitat of the necrosis bacillus, it is needless to descant on the necessity of absolute cleanliness—surgical cleanliness—of all cases, even mild cases of scratches, and the importance of promoting rapid healing.

Necrotic pox.—Smallpox of man and sheeppox are at present considered independent diseases, from either of which the pox (variola) of other animals—horses, cattle, goats, hogs—may originate. So far as the skin lesions of variola are concerned they run essentially the same course, however derived or wherever they may occur. The stages of the eruption are the papular, the vesicular, and the pustular. As a general thing the eruptions are separate, forming the so-called discrete variety. In the severer forms of the disease we may have several pocks running together to form one large pustule, forming the so-called variola confluens, or there may be present a marked petechial condition, hemorrhages into the skin, and mucous membranes occurring even before the papules make their appearance (purpura variolosa), or the pustules may become the seat of severe hemorrhage (variola pustulosa hemorrhagica). The eruptions in these severer varieties frequently progress to that stage of inflammation to which we have referred as necrotic or gangrenous, spoken of by the Germans as variola diphtherica, Brandpocke—gangrenous pox—or, on account of the horrible odor exhaled, Aaspocke—putrid pox. From gangrenous pocks in cows and sows, Bang has recovered *B. necrophorus*, and therefore regards gangrenous or necrotic pox as dependent upon this agent of necrosis. To those acquainted with the ubiquity of this bacterium, the ease with which such infection might occur is strongly confirmatory of this view. Since horses, sheep, and goats are susceptible to the necrosis bacillus, the possibility that the cause of necrotic pox in these animals is identical with that of necrotic pox in cows and sows may well be kept in mind. The present view that horsepox and cowpox originate most frequently from contact with smallpox or its congener, vaccinia, lends interest to the fact that as regards contact with the hand of man the pastern region of the horse is the analogue of the cow's udder. Hence it is likely that some cases of pox in the horse may pass for gangrenous scratches, or grease.

Jensen has described the occurrence in hogs of a necrotic dermatitis due to *B. necrophorus* and located on the muzzle, on the outside of

the lips, and on the feet. Moreover, Leclainche and Vallée [30] have made an unedited observation regarding enzootic necrosis of the lips and nose of sheep from which they recovered *B. necrophorus*. The process advanced until it completely destroyed the lips, making the prehension of food so difficult that death was caused by inanition. In addition, Bang's demonstration of this organism in the deep necroses of the skin of hogs in hog cholera has been confirmed by the findings of such investigators as Lindqvist [21] and Zschokke [41].

NECROBACILLOSIS IN RABBITS.

Four forms of this infection have been reported. In the cases cited by Mazzanti [22] and Schmorl the disease began on the lower lip and gradually involved the lower portions of the head, neck, and breast, the animals dying in about eight days.

A second type reported is characterized by abscesses in different parts of the body—thigh, flank, abdomen. They consist of fibrous sacs, showing no tendency to open, and exuding on puncture a thick, creamy, homogeneous fluid which contains the necrosis bacillus. Emaciation and death complete the disease picture.

The third variety observed presents itself under the form of necrotic dermatitis of different regions of the body. The most frequent phase generally involved the nose and upper lip and was marked by a progressive destruction of tissue reaching to the gums and nasal cavities. In other cases the hind legs and the vicinity of the genital organs became the seat of infection.

Horne [17], in his work on necrosis of the hoof in reindeer, mentions briefly the receipt at the laboratory of a dead rabbit, which on post-mortem revealed multiple necrosis of the lungs due to *B. necrophorus*.

NECROBACILLOSIS IN GUINEA PIGS.

Most authors pronounce the guinea pig almost, if not quite, immune. They generally add, however, that, if infected at all, it is by association of the necrosis bacillus with some pyogenic microorganism. Remembering that *B. necrophorus* operates only on injured tissues, it may be assumed that the guinea pig, being less susceptible than many other animals, requires for its reception of the necrosis bacillus a more severe disturbance of tissue integrity. Again, it may be that the pyogenic organism affects some chemical alteration which lessens the normal resistance of the guinea pig. The two varieties of infection by *B. necrophorus* noticed below should settle all doubt as to the absolute immunity of the guinea pig. In 1885 Eberth [8] described a bacillary necrosis of the liver occurring spontaneously in a guinea pig. His description of the necrotic foci, the line of demarcation between healthy and diseased tissue, the rod forms

and filaments found in large numbers at the periphery, though rarely in the center of the necrotic foci, tallies closely with the well-known features of necrobacillosis of the liver in cattle and other animals and gives sufficient grounds for the statement of Birch-Hirschfeld [2] that Eberth's necrosis bacillus is practically identical with that of Bang.

The second variety has already been referred to in the introduction to this section and may be regarded as similar in type to the second form noticed under "Rabbits."

NECROBACILLOSIS OF THE HOOF.

The more intimate the association of tissues the more difficult it becomes to consider their diseases separately. This is the case in a remarkable degree in the hoof, where we find dermal and subdermal connective and muscular tissues, tendons, ligaments, and cartilages more or less tightly compressed between such unyielding substances as the bones of the hoof internally, and the horny box externally. Simple inflammations, to say nothing of more malignant forms, are rarely limited to the tissue in which they originate. Note how quickly a cutaneous quittor may become a tendinous or cartilaginous quittor, a subhorny quittor cease to be limited to the part immediately below the coronary band and involve the fleshy leaves, thus becoming a more general pododermatitis, or the bone become affected in any of these conditions. The character and limitations of this article forbid such an extensive study of necrobacillosis of the tissues of the hoof as would be required by the separate review of each.[36] The observations of Bang, Eberlein,[7] Fröhner,[12] Gutenäcker,[14] Jensen, McFadyean, and others prove that in the disastrous consequences frequently of such apparently slight injuries as nail in the foot, in all four forms of quittor, in many cases of specific necrotic pododermatitis, which are really cases of canker, in numerous cases of suppurating corn, of necrosis of the coffinbone, of phlegmonous conditions of the frog, we have to do with the presence of *B. necrophorus*.

Necrotic quittor.—In cartilaginous quittor we find the typical instance of necrobacillosis of cartilage. This, as well as the other three forms of quittor, may sometimes arise as a primary necrosis due to some direct injury, such as tread, nail prick, or heavy blow which may puncture or crush the cartilage, the instrument of injury becoming the vehicle of the infectious material. They all may be termed necrotic quittor when the necrosis bacillus is found to be present in the lesions. This condition is first manifested by an inflammation of the tissues, which results in a hot, painful swelling of the coronet over the affected quarter and marked lameness. Finally one opening—or several—appears in the swelling, which discharges a pale yellow or sanious fetid fluid, and which connects with the necrosing

cartilage by means of fistulous tracts. The wall of the hoof below the diseased quarter, stimulated to overproduction by the inflammation present, becomes thick, irregular, and grooved. When treatment is not applied, the disease usually spreads to the ligaments, joints, or even the bones, but an appropriate operation or free drainage, with the injection of strong antiseptic solutions, renders the prognosis very favorable.

Further instances of necrosis of cartilage have occurred in the course of necrotic stomatitis where the disease involves the larynx; and quite frequently in hogs, the cartilages of the nose.

As shown in our review of hoof lesions, even the bone tissue is not exempt from the destructive workings of the necrosis bacillus. All of the varieties of the hoof necroses dependent on this organism are on record as having in some instances involved the bone of the foot. Necrosis of the upper and lower bones of the jaw and even of the vertebræ has been reported in association with necrotic stomatitis. It is worthy of note that Cadiot has reported a case of necrosis of the turbinated bones in the horse, a bacteriological examination of the pus at the necropsy revealing not only streptococci and staphylococci, but also *B. necrophorus*.

NECROBACILLOSIS OF THE DIGESTIVE TRACT.

Caseonecrosis of the esophagus has been observed in both the circumscribed and diffuse forms. It has often occurred as a secondary infection in necrotic stomatitis of calves, adult cattle, and hogs by extension, in these cases frequently involving the whole length of the esophagus (Bang and Jensen). All four stomachs of ruminants have been affected with necrobacillosis. Olt [33] has seen the first three stomachs of a calf thus involved, the necrotic inflammation by its extension producing a peritonitis. He has also found in the paunches of two deer necrotic patches dependent on the presence of *B. necrophorus*, while Jensen has observed the same condition in the rumen of an antelope. Like lesions have been demonstrated in the stomachs of hogs. Necrobacillosis of the intestines has not only been observed in the intestines of cattle affected with necrotic stomatitis, but Bang has also found it in connection with an epizootic among calves in the spring of 1888. The symptom-complex of the latter disease was that of white scour, and the sick animals generally died in a few days. The necropsy in such cases revealed hemorrhages and erosions in the stomach and a diffuse catarrh of the intestine, but no areas of coagulation necrosis. On the other hand, in those cases which ran a long course there were discovered scattered over the intestinal mucous membrane patches of cheesy necrosis, in the periphery of which were demonstrated the bundles of filaments of

B. necrophorus. Just here a few words on proximal and remote causes may be in order. While recognizing the importance of the remote cause, it is to the proximal cause that we give credit for instituting the disease process under consideration. For instance, in necrotic stomatitis the proximal cause is *B. necrophorus;* the remote cause may be the eruption of the first teeth. Note here that the proximal cause is invariable, the remote variable, for, instead of being the eruption of teeth, it may be a sharp-pointed particle of food. Again, the origin of cartilaginous quittor may be nail in the foot, tread, scratches, etc. It is a variable source. But when by our histologic and bacteriologic investigation we find the necrosis bacillus associated with this caseonecrotic process, we are warranted in laying hold of that microorganism as the proximal cause—the cause which gives title to the disease process or which, on the other hand, may receive its name from the disease. So in necrobacillosis of the intestines in calves. The immediate cause of the caseonecrosis is the everywhere-present necrosis bacillus. The remote cause may be any bacterial agent capable of injuring the mucous membrane or chemical effects connected with the food—anything, for that matter, that could produce a catarrhal or eroded condition of the intestinal mucosa.

Necrobacillosis of the colon in the horse has been reported by Bang and of the cecum and colon by Olt. In hogs such caseonecrotic inflammation has been found in the small intestine, cecum, colon, and rectum [Kitt [19]]. Such lesions are not in the least surprising when we recall that *B. necrophorus* has been demonstrated to be an inhabitant of the normal intestine of healthy hogs, and that its invasion of tissue is always secondary to some disturbance of tissue integrity. We would remind the reader of Jensen's experiments regarding white scour in calves. Believing that the organism that is responsible for the disease inhabited normally the intestines of calves and waited only a break in the continuity of the intestinal mucous membrane in order to manifest its pathogenic properties, Jensen fed healthy calves with irritating chemicals and had the satisfaction of seeing them sicken with white scour; and after their death he was able to recover from blood and organs the accused bacillus. While expressing no opinion on the subject, we deem it of interest in this connection to mention the claims of Guiart concerning the etiology of typhoid fever. This observer, while not doubting the claims of *B. typhosus* as the cause of typhoid fever, considers the tricocephalus and other intestinal helminths as lancets of inoculation, the intestinal abrasions caused by them giving entrance not only to the bacillus of typhoid fever, but also to the bacterial agents of dysentery and cholera.

PARASITISM AND NECROBACILLOSIS.

The above is very neatly confirmed by an intestinal lesion in the hog usually regarded as of slight clinical importance. We refer to the cheesy follicles produced by the *Echinorhynchus gigas*. This parasite is an intestinal round worm, infesting preferably the duodenum, to the walls of which it attaches itself by the curved hooks on its proboscis. At the point where it buries itself in the mucous membrane or muscular coat of the intestine there is developed a pea-sized caseous nodule, having the armed head of the worm as its center. Olt,[31] by both microscopic examination of the nodules and inoculation of the cheesy material into rabbits, demonstrated the presence of *B. necrophorus* as the cause of the cheesy degeneration. In this laboratory the same demonstration was made with material forwarded from different abattoirs. The cheesy follicles inoculated into the back of rabbits gave rise to the caseonecrotic lesions characteristic of *B. necrophorus*. Pure cultures from the necrosed material of the rabbits proved as virulent as any derived from necrotic stomatitis of calves or hogs, demonstrated by the rapid development of anovulvitis in a cow.

NECROTIC STOMATITIS.

This is an acute, specific, highly contagious inflammation of the mouth, occurring enzootically in many species of animals, chiefly in calves, lambs, and pigs, and characterized locally by the formation of ulcers and caseonecrotic patches and by constitutional symptoms, chiefly toxic. The disease in calves is also called calf diphtheria, gangrenous stomatitis, malignant stomatitis, and, in pigs and lambs, sore mouth, canker, and ulcerative stomatitis. Necrotic stomatitis of pigs seems not to be infrequent in this country,[27] and reports of its occurrence in the Western, Southern, and Central Northern States have reached this office. Calves have shown the disease in Colorado, Texas, South Dakota, and Wyoming, but no case of the malady in lambs has as yet been brought to our attention. Dammann, Löffler, and Diem, however, have reported its occurrence among lambs in Germany, and it is not improbable that the disease is present in this country and only awaits diagnosis.

Necrotic stomatitis is both a local and a systemic affection. Primarily it is local. The local lesion is the caseonecrotic patch or ulcer, developed as a result of the multiplication of the bacilli at the point of inoculation. The general affection is an intoxication or poisoning of the whole system, produced by a soluble toxin elaborated by the bacilli.

The stage of incubation is from three to five days. Animals have shown signs of the disease when only 3 days old. During this stage

the animal organism is passive and manifests no symptoms. The stage of invasion is twofold—local reaction against the invading organisms and constitutional manifestations of intoxication. The first symptoms noted are disinclination to take nourishment and some drooling from the mouth. An examination of the mouth at this time may show on the mucous membrane of the tongue, hard palate, cheeks, gums, lips, or fauces a circumscribed area of infiltration and redness, possibly an erosion. The latter gradually extends in size and depth, forming a sharply circumscribed or at times a diffuse area of ulceration. It may measure anywhere from the size of a nickel to that of a silver dollar or even larger. It has the appearance of a corroded surface, under which the mucous membrane or lingual tissue seems transformed into a dry, finely granular, or firm cloddy mass. It is grayish yellow in color, and is bordered by a zone of thickened tissue, slightly reddened and somewhat granulated. The necrotic tissue is very adherent and can be only partially peeled off. It is homogeneous, cheesy, and may extend to the depth of 1 inch into the underlying tissue, involving the muscular tissue or even the bones. The general symptoms are languor, weakness, and slight fever. In spite of plenty of good food, the animal is seen to be failing. It stops sucking, or, if older than a suckling, altogether refuses to eat. The temperature at this time may be from 104° to 107° F. The slobber becomes profuse, swallowing very difficult, opening of the mouth quite painful, and a most offensive odor is exhaled. The tongue is swollen and its motion greatly impaired. Sometimes the mouth is kept open, permitting the tumefied tongue to protrude. One or more of the above symptoms direct the attention to the mouth as the seat of disease; or, having noticed the debility and disinclination to eat, an examination of the animal may show a lump under the neck or swelling of the throat or face as a result of the large partially chewed boluses of food that have collected there.

The general affection at this time manifests itself by dejectedness, extreme weakness and emaciation, constant lying down, with stiffness and marked difficulty in standing.

The disease frequently extends to the nasal cavities, producing a thin yellowish or greenish yellow sticky discharge which adheres closely to the borders of the nostrils. Their edges also show caseous patches similar to those in the mouth. Sometimes the nasal passage is obstructed by great masses of the necrosed exudate, thus causing extreme difficulty in breathing. When the caseous process involves the larynx and trachea, there result cough, wheezing, and dyspnea, together with a yellowish mucopurulent saliva. When life is prolonged three or four weeks caseous foci may be established in the lung, giving rise to all the signs of a broncho-pneumonia. Many of

these cases are associated with a fibrinous pleurisy. The invasion of the gastrointestinal tract is announced by diarrheic symptoms.

Ordinarily animals affected with necrotic stomatitis show no tendency to spontaneous cure. Left to themselves, they either die or become permanently stunted in growth. On the contrary, if taken in hand early, the disease is readily amenable to treatment. In the latter event the prognosis is excellent, and under favorable conditions recovery takes place as a rule in twelve to fifteen days.

ULCERATIVE ANOVULVITIS.

This is an infective enzootic of cattle affecting the tissues of the anus, vulva, and adjacent structures, and characterized by the formation of ulcers and more or less loss of tissue. The disease—also called infective ulcerative vulvitis, infectious ulcer of vulva of cattle, infectious vulvar disease, and contagious vulvitis—principally affects the young animals of a herd, and females more than males. The malady was first observed in 1898 in several States of the Central West, and does not appear to be known outside of this country. In heifers and cows the infection usually occurs on the lower portion of the lips of the vulva and in the region of the anus, while in steers it is found around the anus and root of the tail, in some cases involving the gluteal muscles. The disease has not thus far been reported in bulls. The affection is first manifested by a small inflammatory swelling on the inferior portion of the lip of the vulva, on the anus, or on the adjacent skin. The color rapidly fades and the tissue softens, forming an abrasion the size of a pinhead. The erosion spreads rapidly, and frequently several such areas become confluent, forming large phagadenic ulcers of considerable depth, containing grayish yellow or brownish colored débris of necrosed tissue covering a red granulated surface and surrounded by an irregular hemorrhagic zone. This necrosed tissue sloughs off, the secretions being yellowish in color and of a very offensive odor. Although the ulcer may scab over it will, if untreated, continue to spread under the scab and involve large patches of tissue extending deeply into the vulva and adjacent structures, in some cases producing marked deformity of the parts. During the progress of the disease there may be elevation of temperature, loss of appetite, constipation, general appearance of lassitude, and a straddling gait of the hind legs. In a small percentage of cases, usually those that have not been treated, the ulcerations progress to such an extent that death results. In the large majority of animals the disease runs a mild course, lasting from two to five weeks. The period of incubation has been reported by Repp [37] to be from a week to ten days. He cites the apparent contagiousness of the disease by describing healthy animals which after admission to an infected herd took the disease,

and premises which had previously harbored diseased animals as having produced the affection in cattle subsequently placed there. Thus the contagion seems to be confined to certain farms. Our experiments with the disease were made chiefly with tissues received from two outbreaks, one in Western Kansas, investigated by Dr. R. P. Steddom [40], the other at the Pittsburg stock yard among Western cattle. From both of these lots culture inoculations were made and the greatest amount of work was conducted upon a short motile ærobic bacillus, which seemed to be found more profusely than any other organism, but which failed to reproduce the disease when inoculated into sheep and calves. Another organism, long, beaded, and filamentous, was observed which quickly died out on ordinary culture media. From its morphologic character, from its behavior on culture media, and from its position in sections of the diseased tissue it is evident that the germ was *B. necrophorus*. A culture of this organism obtained from the intestine of a hog was injected into the lower portion of the external lip of the vulva of a cow and produced a large edematous swelling which soon ruptured and formed an irregular angry-looking ulcer, from which we concluded that this organism, which was likewise recovered from the suppurating lesion, plays an important part in the causation of the disease. The nature of the affection, its enzootic character, and its amenability to treatment are all in perfect accord with this view, which is further confirmed by the following experiment made by Steddom:

A heifer calf born in the stalk fields on January 1 was placed immediately in an infected pen and kept there for two days, after which it was returned to the stalk fields with the milch cows. Five days later the vulva became affected and remained ulcerated until January 24, when the calf passed from observation.

There is at present no satisfactory explanation for the peculiar predilection of the organism for this region. The fact that the disease has often been observed where hogs have followed cattle in the feed lot gave rise to the assumption that the former bit the cattle in the region of the tail to cause them to rise when lying down, thus making an injury which readily became infected by manure; but other outbreaks have been noted where hogs were not present and therefore could not be considered as factors in the production of the disease. The possibility of its existing secondarily to necrotic vaginitis suggests itself, but has not been demonstrated.

NECROTIC VAGINITIS.

A somewhat similar disease to the above, but one which has not been observed in this country, is the infectious necrotic vaginitis described by Ellinger. This disease has been observed in certain parts of Ger-

many and in Italy as an enzootic among cattle usually from three to eight days after calving. It is characterized by tumefaction and reddening of the vulva, the formation of ulcers and caseonecrotic patches on the mucous membrane of the vagina, and by an excessive vaginal discharge, at first serous, but later grayish and of an offensive odor. Fever and anorexia are present, the urine is passed at frequent intervals, and vaginal contractions are noticed. From the lesions of the vaginal secretions Ellinger has succeeded in isolating *B. necrophorus*, and concludes that the modification which takes place in the vagina at parturition exposes it to the causative bacillus that may be present in the manure, bedding, or on the hands of the obstetrician or his instruments. This writer also states that it is often observed with a coexisting outbreak of foot-rot of cattle on the same premises. The course of the disease is from three to four weeks, and where uterine complications are absent the prognosis is generally favorable.

NECROTIC METRITIS.

This disease is really a complication of the foregoing and results from the preexisting disease in the vagina spreading by continuity of structure to the mucosa of the uterus. The lesions observed are similar to those seen in the vagina and consist in swelling and injection of the mucous membrane, followed by erosions and sloughing of the mucosa. The uterine cavity is distended by a serosanguinolent fluid containing flocculi and shreds of necrosed tissue and becoming very malodorous. The ulceration may extend to the muscular walls of the uterus and petechial hemorrhages may be observed on the serous membranes of the body, together with enteritis, injection of the spleen, and other indications of septicemia. In some of these cases necrotic lesions of the anus and rectum have been observed, suggestive of anovulvitis, in this country, as well as of the urethra, ureters, and kidneys. The symptoms manifested are those described for necrotic vaginitis, but are more accentuated. There is evidence of much pain, the fever increases rapidly, coma comes on, and the animal dies. The course of this affection is rapid and the prognosis grave.

FOOT-ROT OF CATTLE.

A variety of causes has been ascribed for this affection, and it is probable that many of them are important agents in reducing the vitality of the parts for the subsequent invasion of the necrosis bacillus. In two outbreaks of this disease, which is also termed foul in the foot, panaritium, and panaris, we have been able to isolate *B. necrophorus* and to prove its identity by cultural and animal experiments. One outbreak, brought to our attention through the kindness of Dr. S. H. Johnston, occurred at Ambler, Pa., among a herd of

registered Guernsey cows recently imported from England. About 30 per cent of the animals showed evidence of the disease. Three years before the same disease was likewise imported from England by this breeder with another consignment of Guernseys, but no investigations of the lesions were made at that time. The second herd affected with the disease, and from which the necrosis bacillus was recovered, was located at Rochester, N. Y., and the material for examination was forwarded through the courtesy of Dr. W. O. Marshall, milk inspector of Rochester. This affection has long been recognized by the Germans as being contagious and as caused by *B. necrophorus*. Thus Bang,[1] Hess,[16] Von Imminger, and others have studied numerous outbreaks of the disease caused by the entrance of this bacillus after some primary injury to the part. It has generally been considered in this country as a filth disease, though some have held that it was contagious, owing to its spread to other cattle in the same herd, but heretofore the necrosis bacillus has not been isolated from the affected feet. Its contagious character is further indicated by the fact that the disease has been reported in this country as a forerunner of necrotic stomatitis of calves and as coexisting with necrotic vaginitis and metritis in certain parts of Germany. The symptoms of foot-rot are brought to one's attention by the apparently sudden lameness of the animal. On examination the hoof will be found to be hot, swollen, and very painful. The toes of the hoof are usually widely separated in consequence of the swelling, and frequently the tissue of the interdigital space is softened and ulcerated. The swelling may extend up the leg almost to the knee as the result of the necrotic process extending into the deeper tissues, forming fistulous tracts, abscesses, and ulcerative patches about the heel and pastern. The pus may burrow under the horn, involving the ligaments, tendons, and even the bones in its necrotic progress. The disease usually affects two or more feet of an animal, showing predilection for the hind legs. The course of the affection depends on the time when the treatment is first started. It usually lasts from five to six weeks, or even longer when the condition is neglected until far advanced. In such cases the animal becomes so lame that it remains lying all the time, appetite is lost, milk secretion suppressed, emaciation marked, fever is present, and death follows from absorption of the toxic products.

FOOT-ROT OF SHEEP.

A disease similar to the foregoing, but which does not have such a marked tendency toward extension up the leg and formation of fistulous tracts, is foot-rot in sheep. This affection has been recently studied in this laboratory,[28] with the result that *B. necrophorus* was for the first time proved to have an etiologic relationship to the

disease. The first evidence of foot-rot is a slight moisture of the interdigital membrane, which is soon associated with reddening and erosions, particularly near the heel. The inflammation rapidly progresses, forming ulcerations, from which exudes a thin purulent fluid of a characteristic pungent odor. Lameness then becomes marked, and the region of the foot above the hoof appears swollen and painful. Fistulous tracts form beneath the horny wall of the foot, which later cause loosening of the horny tissue and sometimes necrosis of the ligaments and adjacent structures. In the chronic form of the disease the continued irritation of the bacteria causes a development of fungoid growth, while the hoof of the sheep grows out rapidly, becoming hard with thickened and elongated claws which curl up like sled runners. Walking may become so painful that the sheep lies down continuously; the temperature rises, appetite is decreased, and the animal rapidly becomes emaciated. The prognosis is very favorable when treatment is applied in the early stages of the disease, a cure resulting within ten days. It is very rare for death to occur as a result of foot-rot, although in virulent outbreaks involving three or all four feet of each sheep the affection may terminate fatally within two months.

Horne has described the disease as it occurs in reindeer and succeeded in proving the necrosis bacillus to be the etiologic factor.

NECROTIC OMPHALOPHLEBITIS.

This disease is found among young animals and consists of an inflammatory condition with firm swelling of the navel and the surrounding tissues. Later this swollen mass, which is hot and painful, rapidly softens in the center, undergoing suppuration and necrosis. The necrotic process causes an irregular cavity at this point, which may reach the size of a silver dollar and is associated with a sanious, fetid discharge. The general symptoms are fever, loss of appetite, diarrhea, and occasionally death. Microscopic examination of the necrosed tissue from the umbilicus and inoculation experiments have shown, in the hands of McFadyean,[23] Jensen,[18] Olt, and others, that *B. necrophorus* is the causative agent. The difference between this affection and similar diseases produced by infection of the umbilicus with pyogenic cocci, or the organism of white scours, is one only of degree, as in the former case the necrosis and consequent cavity formation are more marked and there is a greater tendency toward complication of the joints, with bone necrosis, as will be referred to below, or to necrotic stomatitis, resulting from the calf licking the diseased navel and infecting the mucous membrane of the mouth, a method of infection which has been observed by Mettam [24] in a number of calves.

JOINT-ILL.

This disease, also called joint-evil, is not infrequent among young animals, especially calves and foals, and occurs within six weeks after birth. The disease is localized in the joints, but the infection may reach the liver or other viscera, causing small areas of necrosis. One or more joints may be involved, a condition manifested by local painful swellings. The animal is stiff and lame and lies down most of the time, showing fever, inappetence, and accelerated respiration. The joint cavity is filled with pus, which finally causes ulceration of the cartilage and even necrosis of the adjoining bone. In the purulent material of the joint *B. necrophorus* has been found by Mettam [25] and others, who claim that the disease starts in such cases by infection of the umbilicus with the necrosis bacilli. Of course, it is not to be presumed that all cases of joint-ill are caused by this organism, since it has been proved definitely that the pus-producing cocci and the bacillus of white scour may enter the unhealed umbilicus and be carried by the umbilical vein to the liver, where they are thrown into the circulation to become localized in one or more joints. But the very fact that this does not occur in the latter cases presupposes the probability of the same occurrence with *B. necrophorus.*

MULTIPLE NECROSIS IN LIVER, LUNGS, AND OTHER VISCERA.

Among the first lesions in which *B. necrophorus* was recognized in this laboratory were necrotic nodules in the liver of a deer which died at the National Zoological Park and in livers of cattle shipped to this office by the meat inspection force at Kansas City and Chicago in 1900 for diagnosis. The organism had evidently been observed at an earlier date by Theobald Smith in the intestinal ulcerations of hog cholera, as has been shown above, but it was not until the last two years that the bacillus was recovered and studied in pure culture in this laboratory.

The livers above mentioned were somewhat enlarged in size and presented on the surface and sometimes within their parenchyma a number of necrotic areas of varying sizes from a grain of wheat to a walnut, sharply delimited from the apparently healthy tissue adjacent. These nodules were usually firm in consistency, of a greenish or grayish-yellow color, irregularly rounded in outline, and extending like an infarct into the normal tissue. On the border line between the normal and diseased tissue numerous columns of necrosis bacilli may be observed on microscopic examination, but not in the center of the dead tissue.

Later the areas of necrosis become circumscribed by dense fibrous capsules, while the contents are softened and changed into a greenish-yellow pus. The number of these areas in the liver is variable, most

frequently from ten to twenty, and, as a rule, they approach a hickory nut in size. McFadyean has reported their occurrence not only in the liver of cattle, but also of sheep [a] and in the lungs of horses. In the latter cases the nodules are about the same size though softer in consistency than in the liver, sometimes containing thick grayish-yellow pus in the center. They occasionally reach the size of a goose egg and the pleura over the necrosed areas becomes thickened and gelatinous. Multiple areas of necrosis have also been reported by Bang in the muscles of the heart, which in one case was embolic, and in the other case of traumatic origin. Such lesions as have been described as occurring in the liver, lungs, and heart of animals are not suspected during life, since no symptoms referable to them have been observed. The first knowledge that such lesions exist is obtained by postmortem examination. Whereas multiple necrosis of the liver of cattle is not infrequently seen by meat inspectors in their postmortem work, such animals on antemortem examination do not reveal the least evidence of these lesions. The most interesting feature connected with this condition is the possible paths of infection of this bacillus. It has been concluded by McFadyean that, in certain cases observed by him, an external lesion of the hock or superficial sloughing of the skin was the point of entrance of the germ. In those cases in which no such ulcerating surfaces are present it is presumed that the bacillus enters the alimentary canal and reaches the portal circulation, whence it is disseminated throughout the liver with resulting areas of necrosis. It is also possible, as Ostertag,[35] Edelmann,[9] Olt,[32] and Meyer [26] have suggested, for these organisms to reach the liver through the umbilical vein by infection of the navel. It is not unlikely that following the healing of the navel these centers of infection in the liver remain as the only result of such omphalic contamination, and hence on slaughter no other lesions may be observed in the carcass. The foci in the lungs and cardiac necrosis can be readily explained as of embolic origin from the bacilli circulating in the blood. Thus Nielsen [29] described two cases of pulmonary necrosis in horses following scratches, and Caudwell [3] a similar case. The latter observer had previously reported one case of multiple necrosis in the lung of a calf, in which the lesions were metastatic and secondary to an ulcerative patch on the palate of the animal, and similar necrotic areas in the heart, kidney, and voluntary muscles of cattle.

Jensen and Georgewitsch [13] have likewise reported bacillary necrosis in the kidneys as well as in the spleen of cattle.

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[a] Although McFadyean has not furnished satisfactory proof for this assertion, the fact that bacillary necrosis does occur in the liver of sheep has been determined by the experiments of Mettam [25] and Edelmann,[9] the latter also observing it in the liver of hogs, horses, and dogs.

HOG CHOLERA AND NECROBACILLOSIS.

There can be no doubt that hitherto the hog-cholera bacillus has been given too much credit for the lesions customarily seen in that disease. As long ago as 1887 it was surmised by Schütz, and demonstrated in 1889 by Bang and later confirmed by Zschokke, Olt,[34] and others that the superficial necroses occurring in the intestine and stomach of cases of hog cholera were due to the hog-cholera bacillus, whereas the deeper necroses were invariably dependent upon the presence of *B. necrophorus* playing, as secondary invader, its rôle of producer of deep and progressive tissue necrosis.

This view is still further confirmed in our minds by a recent study of a number of histological preparations belonging to this laboratory and made by Prof. Theobald Smith during the investigation of hog cholera in the eighties. Slide No. 19, dated October, 1884, marked "Hog cholera, ulcer of the stomach," number of pig not given, reveals superficial ulcer, great numbers of micrococci, and short rods. On the other hand, sections of ulcers of stomach from pigs Nos. 125, 140, and 145 show ulcers penetrating deeply into the submucosa. At the base of these ulcers is to be seen a deeply stained ribbon made up of bundles of long filamentous bacilli enveloping in their meshes numerous round cells and leucocytes. Between this line and the still sound portion of the intestinal wall is an area of poorly stained cells bespeaking in all probability the incipient necrosis produced by the toxin of the advancing necrosis bacilli. Slides from intestinal ulcers and ulcers of the colon of pigs Nos. 67, 71, 72, 73, and 121 all show the superficial portions of the necrosed intestinal wall crowded with micrococci and short rods, but in the deeper portions of the ulcers penetrating the loose connective tissue structure of the submucosa are to be found invariably the long, wavy, beaded filaments so characteristic of *B: necrophorus.*

As additional evidence we refer to recent examinations made by us of caseonecrotic lesions in hogs just dead of hog cholera. In all such chronic lesions, whether of the stomach or intestine, we found in the deeper portions on the border line between the healthy and diseased tissues numerous bundles of *B. necrophorus*. Inoculation of such material into the back of a rabbit resulted in the usual coagulation necrosis, bearing out the statement of Theobald Smith that "in rabbits the local effect of such inoculation is usually quite severe."

AVIAN DIPHTHERIA AND NECROBACILLOSIS.

It must be acknowledged that the final word on the etiology of so-called avian diphtheria has not yet been spoken. Till then the specificity of the disease is open to question. The almost universal acknowledgment that the word " diphtheria " should be associated only with

the Klebs-Löffler bacillus makes the title "avian diphtheria" a misnomer for the affections usually so denominated. It is admitted on all sides that various microorganisms possess the power of producing diphtheric inflammations—that is, inflammations characterized by the production of a membrane. The several microorganisms, more or less pathogenic, sometimes in pure culture, recovered by different investigators from various outbreaks of pseudomembranous inflammations of the mouth and throat of chickens and other avian species speak loudly in favor of this position. The failure of equally able men to recover from equally virulent outbreaks the same microorganism is still further confirmatory. In numerous necropsies of different species of birds affected with exudative and pseudomembranous inflammations of the mouth, nose, and throat we have been struck with the decided tendency toward localization of the lesions in those regions, the failure to recover any organism from the blood, and the enforced inference of death from toxinemia. Some recent bacteriologic findings in this laboratory have increased the importance of these observations. From the exudate in the mouth of the kite, to which reference has already been made, was recovered by cultural and animal inoculation methods a pathogenic variety of *Bacterium ærogenes* together with *Bacillus necrophorus*. From two chickens affected with diphtheritic roup and representing different flocks and different outbreaks was recovered, by cultural and animal inoculation methods, *B. necrophorus*. In the case of one chicken there was also associated a nonmotile rod pathogenic for rabbits; in the other a nonpathogenic organism was associated with the necrosis bacillus. The bacteria above mentioned were in neither case pathogenic for chickens nor were lesions produced by the injection of *B. necrophorus*. It is more than a mere inference—in fact, it is a logical deduction—when we assume that the local depredations of associated bacteria or other irritating agent offered to the soil- and manure-contaminating necrosis bacillus a ready entrance into the tissues as a secondary invader.

We do not consider that we have settled the question of avian diphtheria. We do wish the name could be abolished and for such affections in the avian species titles be used that are more in accord with the pathologic findings. Remembering that Ritter found the necrosis bacillus in association with what he called avian diphtheria, that Jensen has lately recorded some unpublished investigations by his assistant Leth in the same line, we suggest deep-going local antiseptics in the treatment of all pseudomembranous affections of the mouths of chickens and other birds, and at the necropsies of all fatal cases of such affections careful search for *B. necrophorus*.

EXPERIMENTAL PATHOLOGY.

Inoculation experiments are an important aid in diagnosis. The tissue changes in the rabbit and mouse after inoculation with *B. necrophorus* are so characteristic as to become an essential factor in the identification of the microorganism. Furthermore, the work of recovering the necrosis bacillus is much simplified by the use of these animals.

EXPERIMENTS ON RABBITS.

Subcutaneous method.—These animals are highly susceptible to the action of *B. necrophorus*, and to this susceptibility is due the ease with which the presence of the germ in diseased tissue may be demonstrated. A bit of tissue adjacent to the border of the necrosed area is emulsified in a normal saline solution. The subcutaneous inoculation of a rabbit with 0.5 c. c. of this emulsion will result in the death of the animal within one week. In order to free the tissues of the experiment animal from other forms of microorganisms naturally present in material taken from a necrotic area in contact with the outside world, it is advisable to use a second or even a third rabbit. The first rabbit will, however, in spite of the contaminated material used in its inoculation, show very characteristic lesions, which can be referred to the action of no organism other than the bacillus of necrosis. The chief of these typical changes will be noted at the point of inoculation, where, lying beneath the skin and extending down for a greater or less depth into the muscular tissues, is found an irregular area about 1½ to 2 inches in diameter. This area offers to the naked eye much the appearance of a flattened mass of soft, fresh putty, and to the nose the penetrating odor already referred to as between the smell of cheese and that of glue. This pulpy, yellowish-white malodorous mass is the detritus of muscular, fatty, and vascular tissues which have been attacked and destroyed through the presence of the necrosis bacillus as well as by its effective poisons. Reaching out into the surrounding tissues for about 1½ inches in all directions is found a zone of inflammatory tissue, and the subcutaneous and muscular tissues of the abdominal region are inflamed and edematous through extension by gravitation of the disease process from the local lesion caused by inoculation. Not seldom in these cases is there to be observed a marked development of gas bubbles. Frequently that portion of the large colon adjacent to the diseased abdominal wall is greatly injected and adherent to the parietal peritoneum by a plastic exudate containing numerous short and long forms of the bacillus of necrosis. This part of the peritoneum is also inflamed and presents petechial hemorrhages. Examination of the soft mass found in the necrosed area at the point of inoculation shows that it is penetrated

in every direction by long threadlike bacilli, and the subcutaneous inoculation of a second rabbit with a small scraping from this mass serves to eliminate a large proportion of the contaminating organisms. Because of the greater purity of the material now used, the inoculation will not result fatally until a period usually from eight to fourteen days, although occasionally death has been deferred nineteen, and in one case twenty-three, days. In many instances it will be found that this longer period has proved sufficient to allow the circulation to take up a few of the bacilli and deposit them in the plexuses of the lungs, liver, or kidneys, where small, yellowish-white spots of necrosis will result, which may be readily peeled out as if in a capsule.

From these secondary visceral necroses pure cultures of *B. necrophorus* may now be obtained, and its further development secured by the utilization of anaerobic methods of culture. The injection of 0.5 c. c. of these pure cultures under the skin of the back produced the same characteristic yellowish-white area of muscular necrosis about the point of inoculation and the peculiar penetrating odor so constant with this bacillus. The course of the disease is about the same as when an emulsion of the fresh tissue has been injected, and in those cases in which life was prolonged several weeks metastatic areas of focal necrosis were always noted. The approach of death is usually indicated by convulsions; the animal comes out of one to be seized with another, death generally resulting in a few hours after the onset of the first convulsion. In the majority of rabbits that succumbed to this disease a marked rigor mortis was observed, especially noticeable in the hind quarters, causing the back to be arched and the legs contracted as if in a tetanic spasm. Microscopic examination of tissue taken from the necrosed area or from metastatic lesions of the liver or lungs shows the presence of typical necrosis bacilli in great numbers. In the case of organic lesions these filaments are seen to be arranged along the border of the area of necrosis, whereas the central portion is amorphous and does not reveal the presence of any microorganisms.

Intravenous method.—The intravenous method of inoculation was adopted in nine cases, four of which resulted in the death of the animal. Each rabbit received in the posterior auricular vein 0.3 c. c. of an emulsion of the tissue filtered through cotton, the filtrate containing numerous bacilli.

The course of the disease ranged from seven to twelve days. The symptoms exhibited in all cases were the same as those induced by subcutaneous inoculation, and consisted of gradual emaciation, followed by the loss of appetite and by convulsions, paralysis, and death. The postmortem examination showed the principal lesions to be

located in the thoracic cavity. The lungs contained several caseous nodules the size of peas surrounded by a hemorrhagic zone, and in one rabbit the left principal lobe was adherent to the costal pleura by a thick, purulent exudate. In each case the costal pleura contained several metastatic foci, and the chest muscles in two instances were the seat of one or two localized areas of coagulation necrosis. In another the caseous process had included the entire surface of both lungs, the pericardium, and the heart itself, until all were superficially fused into one cheesy mass. The liver of one animal contained eight superficial areas of caseation varying in size from a pea to a hazelnut and was adherent to the diaphragm and abdominal muscles. All other organs were normal. No lesion was observed about the point of inoculation in three cases; the fourth showed a narrow strip of necrosis along the line of the vein for about half an inch. Cover-glass preparations made from the lesions contained numerous characteristic specimens of *B. necrophorus*.

EXPERIMENTS ON MICE.

Subcutaneous inoculation.—The remarkable susceptibility of the white mouse to "necrophorus infection" makes this animal an excellent medium for the preservation of the virulence of that microorganism, as well as a means of obtaining it in pure culture. Unfortunately, this animal's extreme susceptibility to many forms of bacteria usually found in necrotic areas disqualifies it for use in the early stages of an investigation. The inoculation experiments may be carried on by placing a small bit of necrosed tissue in a pocket in the skin of the back, or by injecting into the same region 0.1 c. c. of a fluid culture or emulsion containing the germ in a pure state. In two to four days the point of inoculation is covered with a rather thick, blackish, or dark-brown dry scab, around which is a zone of redness. Beneath this scab proceeds a coagulation necrosis spreading through the subcutaneous tissues until the mouse is completely mummified, shriveled up, and covered with a dry parchment-like coating; or, penetrating into the body cavities in its course, successfully caseates muscle, cartilage, bone, and viscera. In some of these cases so general becomes the caseous process that it is difficult to decide whether the viscera have suffered embolic necrosis or have become involved in the progressive caseation through extension by contiguity. In cases in which necrotic action was less widespread small focal necroses containing *B. necrophorus* in pure culture were found in the lungs, liver, and spleen. In our experiments mice have died as early as five and as late as twenty-one days.

EXPERIMENTS ON GUINEA PIGS.

Guinea pigs were inoculated with pure cultures of necrosis bacilli by both the subcutaneous and intraabdominal methods, but these were followed by negative results. Nine animals were used in the experiments, and doses ranging from 0.25 to 1 c. c. of a forty-eight hour bouillon culture were injected without producing any unfavorable effects. However, one positive result was obtained in guinea pig No. 3181, which was injected intraabdominally with 0.5 c. c. of an emulsion of the necrosed tissue taken from the mouth of a calf. Death followed on the tenth day. On autopsy the carcass appeared emaciated. The point of inoculation in the prepubic region was surrounded by an abscess several millimeters in diameter containing a rich yellowish pus. In the linea alba, several inches above this abscess, was an extensive nodule 1.5 cm. in diameter, involving the muscular tissue and the peritoneal lining. It contained the same character of pus. On the right side of the linea alba the peritoneum was adherent to the contiguous loop of the colon opposite the last rib. The right and left lobes of the liver were almost fused into one by abscess formation. The right lobe particularly was the seat of several abscesses 1½ cm. long by 1 cm. wide, with a line of demarcation plain and straight between the part absolutely necrosed and the invaded portion. The spleen appeared mottled and slightly enlarged, and the kidneys were deeply congested. The lungs were engorged on the right side and showed one or two foci of hepatization. The presence of *B. necrophorus* in these liver abscesses was demonstrated by microscopic preparations and by animal inoculations.

GENERAL PROPHYLAXIS.

Prophylaxis should be carried out in various ways, according to the particular character of necrobacillosis to be prevented. Thus joint-ill, omphalophlebitis, and such cases of multiple necrosis of the liver and other viscera as arise from infection of the umbilicus may be prevented by the following precautionary measures: The female, at the end of the period of gestation, is provided with dry, clean bedding and comfortable quarters. The external genitals and tail are washed with 3 per cent creolin or lysol solution. Immediately after the birth of the young its umbilical cord is cleansed and disinfected by an application of the same solution, followed by painting it with flexible collodion, or a solution composed of 1 pint of wood alcohol and 15 grains of iodine. By this treatment the navel is rid of contaminating organisms, and the exposed blood vessels at that point are closed as paths of infection.

Again, in necrotic stomatitis, prevention would consist in the thor-

ough disinfection once daily for five days of the mouths and nostrils of those animals that have been exposed by the eruption of the first teeth or by the shedding of the milk teeth or through association with affected animals. In preventing necrotic quittor and scratches it is necessary to take all wounds and injuries of the hoof early and treat them antiseptically to prevent their contamination with the necrosis bacillus. To avoid necrotic vaginitis absolute cleanliness should accompany all treatment of obstetrical cases and prompt repair be made of all lacerations and other injuries of the genital tract following parturition. In all forms of necrobacillosis it is essential to separate the sick from the healthy animals, and to disinfect completely all stalls, sheds, pens, etc., with a 5 per cent solution of carbolic acid, to which has been added sufficient lime to make the disinfected area conspicuous. As it has been shown that the large majority of species of domestic animals are susceptible to this infection and that a constant relation may exist between an attack of one form of necrobacillosis and the previous occurrence of another type of the infection in the same or another species of animal on the place, it behooves one to prevent any susceptible animal of whatever species from coming in contact with a diseased one, or with such stalls, sheds, manure, and old bedding as might be harborers of the contagion.

GENERAL THERAPEUTICS.

In those cases of necrobacillosis with external lesions the treatment consists, first, in removing the caseous patches or necrotic tissue in order to expose the causative agent. The latter being an anaerobe, exposure to the atmosphere will of itself prove beneficial. Removal of the necrosed material may be accomplished by the use of a curet, knife, or hot iron. The exposed area should then be treated as a common wound by washing it thoroughly with antiseptic solutions, especially Lugol's solution or 5 per cent carbolic acid, which seem to have a greater effect on the bacillus than most germicides. The formation of granulation tissue in exposed regions may be stimulated by antiseptic salve, such as carbolized vaseline, or by dressings of camphor or calomel. In necrotic quittor, where the cartilage has become involved, it is advisable to inject strong caustic solutions for the purpose of destroying the diseased tissue or to extirpate the diseased cartilage by an operation, followed by the usual antiseptic dressing. In necrotic vaginitis and metritis douches of warm antiseptic solutions, such as 1 per cent carbolic acid, creolin, or lysol, are indicated. Success has followed the treatment of anovulvitis with 5 per cent solution of carbolic acid or creolin and the subsequent application of silver nitrate to the ulcers as a caustic. The treatment of multiple necrosis of the viscera is not possible, as the symptoms are

rarely noted, and even if they were diagnosed remedies would not avail.

ECONOMICS.

This, the objective point of the paper, our readers will concede has been kept before us throughout the entire discussion. In necrobacillosis we have a many-sided affection of vast importance to the agriculturist and of considerable interest to those in control of zoological gardens. It may locate itself in any tissue. Few, if any, animals are immune from natural infection by it. Any disturbance of tissue integrity, whether by disease or traumatism, opens the way for its invasion. Its bacillary agent, *B. necrophorus*, is everywhere present, notably in manure and manure-contaminated soil.

Its presence in any part of the body is a menace to the joints and viscera by reason of its metastatic tendencies, and an almost certain harbinger of death by general intoxication. The existence of the disease in one animal endangers the growth, usefulness, and even life of every other susceptible animal on the farm. The ease with which it is grafted on a damaged tissue is equaled only by the facility with which it may be ousted by the early use of energetic antisepsis. The fact that it is enzootic instead of epizootic makes it no less costly to the farmer whose stock becomes the sphere of its operations. In short, in *B. necrophorus* and necrobacillosis we have an ever-impending danger concerning which it is not too much to aver that its presence is as common as that of manure, its inoculability as easy as that of blackleg, its financial depreciation of the individual attacked as positive as that of scabies, its fatality as high as that of foot-and-mouth disease, and its treatment as simple as that of epizootic lymphangitis. Nevertheless, the disease is not one which, like some others, the Government can by sanitary regulations proceed to eradicate. The individual farmer, aided by the weapons of veterinary science, must battle with it himself.

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FOOT-ROT OF SHEEP.[a]

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HISTORICAL REVIEW.

Foot-rot was first described by Chabert in the year 1791 as existing north of the Pyrenees on the banks of the Gironde and lower Medoc. Later it spread to central France, and was described by Pictet in 1805 and by Gohier in 1808, both of whom declared it to be a communicable disease. It was likewise observed about this time in Piedmont, Italy, and spread into Germany about 1815 as a result of the introduction of French Merinos. Not only has it appeared in epizootic form in continental Europe, but it has also spread through Great Britain, Australia, and the United States, where it was not infrequently observed during the past century.

The date of its first appearance on American soil is unknown. The statement has frequently been made that the disease was brought to American shores by the colonists through importations of Spanish Merinos, and this statement seems to have been accepted by many writers without question or discussion. The first importation of Spanish Merinos for breeding purposes is reported to have been made in the year 1808, but the disease had become well established in this country prior to that time. Another reason for considering sheep from Spain very improbable as originators of the disease upon American soil is the fact that the sheep of Spain have been remarkably free from foot-rot. It is even asserted that it has never been seen on the dry table-lands which constitute the pastures of the entire region south of the Pyrenees. Spanish Merinos may have introduced the disease here, but it is very probable that they were first shipped from Spain to some other country, and thence, after a longer or shorter stay in their new home, reshipped, together with an infec-

[a] This paper is an abstract of Bulletin No. 63 of this Bureau.

tion of foot-rot, to America. It has been historically stated that the first settlers who attempted to establish flocks of sheep upon the prairie farms of Ohio, Indiana, and Illinois met with most disheartening experiences, which were in a measure due to the spread of foot-rot. In the year 1797 an agricultural settlement was made in Illinois by farmers from the eastern colonies, who brought with them flocks and herds of the sheep and cattle common to the section of the country whence they came. During the decade following many new homes were established in the prairie regions, and a number of the settlers brought with them foundation stock with the intention of growing large flocks of sheep, but wolves and panthers proved to be very destructive, and liver disease and foot-rot also hindered the establishment of large bands, until finally the pioneers were forced to be content with small flocks that could be constantly housed, guarded, and given careful attention.

The farmers of Maryland and Virginia were taking an increasing interest at this time in improved sheep. They had many discouraging conditions to contend with, and although it is possible that foot-rot was not known among their flocks at this time, it is certain that much trouble was caused by the appearance of "diseases, dogs, and wolves," and that contagious foot-rot made itself known and feared as early as 1832 in these States.

Owing to the imperfect knowledge at that time of matters pertaining to bacterial diseases, the sheep owners struggled against the spread of foot-rot in their flocks somewhat unsuccessfully, and it often required constant watchfulness and persistent treatment for three or four years to eradicate the disease after it had become thoroughly established upon the premises of the sheep grower.

Later than this, in the late fifties and early sixties, there was a marked revival of interest in sheep raising throughout the Middle West, and at this time many who had previously devoted their energies exclusively to grain or to cattle and hogs, concluded to change over to sheep, and the resulting traffic in these animals caused them to be moved about over the country roads and into new sections of the agricultural regions in numbers never before equaled. In several instances these traveling flocks carried foot-rot with them and infected the flocks with which they came in contact along their routes. The States of Ohio, Michigan (southern), Illinois, and Iowa were most seriously infected, and in all of them the disease secured such firm foothold that several years of strenuous combat were necessary before it was even partially subdued. It was during this period that a sheep raiser of long practical experience, in writing from his home State, Ohio, made the statement that farmers in his part of the country had in times past been seriously troubled by

the appearance of stubborn outbreaks of foot-rot among their flocks of sheep. In no case, however, had he been able to discover the spontaneous appearance of the disease, but with a little persistent inquiry it had been an easy task to trace the origin of each outbreak to the careless handling of diseased sheep brought from other localities. Since that time the disease has appeared frequently, but its spread has never assumed such alarming proportions, and, owing to a better understanding of the malady, it has been more successfully controlled.

SYMPTOMS AND LESIONS.

The first evidence of an attack of foot-rot to attract the attention of the shepherd is a slight lameness, which rapidly becomes more marked. Previous to this, however, there has appeared a moist area just above the horny part of the cleft of the foot, and this has gradually reddened and assumed a feverish, inflamed appearance. It may first become visible either at the front or back part of the cleft, but usually the erosions make their first appearance at the heel. The inflammation rapidly penetrates beneath the horny tissue, while from the ulcerous opening there exudes a thin, purulent fluid. The lameness has increased and the region of the foot above the hoof is becoming swollen and warm to the touch. The exudate from the erosions contains pus cells, bits of destroyed tissues of the foot, and bacteria. It possesses an odor pungent and disagreeable, but at the same time very characteristic. The experienced sheep man is frequently able to detect the presence of the disease in a flock of sheep, even though it be while making a casual visit to a strange flock, simply by means of the diagnostic and unmistakable odor which arises from the affected feet. This odor is so pathognomonic of the disease that it would reveal the presence of affected sheep to one familiar with the character of the infection, even before noticing the animals.

The erosion progresses, if no treatment is applied, and there is rapid formation of fistulous passages beneath the horny covering of the foot, while the softer tissues of the interdigital space are gradually becoming degenerated and purulent. The invading microorganisms possess marked burrowing propensities, and the result of their activity is that large areas of the hoof become loosened from the sensitive tissues lying beneath.

The invasion of the necrotic process may continue until ligaments, tendons, and even the bones are attacked; but before this final stage is reached nature will attempt to repair the damage, and for this purpose the secretion of formative elements in the injured part is greatly increased, until there appears a peculiar growth composed of horny elements, dense epithelial cells, and granulation tissue. These unsuc-

cessful attempts at renewed development of tissue are termed "fungoid growths," and they have been known to materially hasten the shedding of the horny covering of the foot by their persistent enlargement within the ulcerous channels cut by the advancing infective elements.

The hoof of a sheep suffering from a chronic case of foot-rot grows out rapidly and becomes very hard. It will often be found with the toes so thickened and lengthened that the front part of the foot is raised above its natural incline and the tendons at the heel are subjected to additional strain, all of which tends to increase the lameness and the awkwardness in gait of the victim. These thickened and

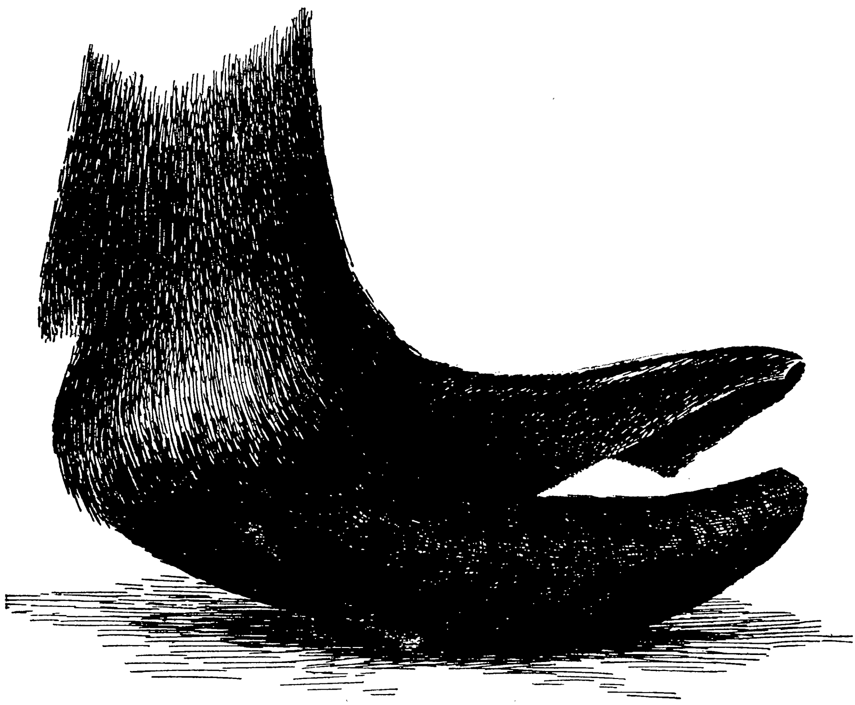

FIG. 1.—Hoof of sheep showing effects of chronic foot-rot.

elongated toes will frequently be seen to have attained an added length of 3 or even 4 inches, and they curl up like sled runners, greatly interfering with the progression of the animal. (See fig. 1.)

The sheep finds the act of walking so painful when the disease has become thoroughly established that it remains quietly lying in some secluded corner or, if diseased in the forefeet only, crawls around on its knees in its efforts to keep with the remainder of the flock or to get within reach of its food. Its temperature rises until there is evidence of considerable fever. The appetite is seriously impaired and the patient rapidly loses condition and weight.

During warm weather there is great danger of an attack by maggots as soon as the lesions are discharging freely, and unless these are quickly removed they will appear in such numbers as to rapidly bring the course of the disease to a fatal ending. They not only invade the affected feet, but will also locate at any point of the body at which the wool has become sufficiently contaminated by the purulent discharge from the ulcerous tracts to afford them a suitably moistened breeding place. The wool on the sides of the body is frequently more or less soiled from contact with the diseased feet while the animal is lying down, and it is in such areas that the fly deposits the eggs that hatch into destructive larvæ. As soon as the maggots are hatched they begin to burrow into the tissues upon which they are located and they quickly perforate the skin of their host, thus causing complications which bring its suffering to a close.

COURSE AND SUSCEPTIBILITY.

The course of this disease is slow and protracted, usually starting with one foot and subsequently involving one or more of the others. During this interval it would probably have likewise spread to the feet of other sheep, and in this way the disease may remain for several months in each member of the flock and for eight or ten months in the flock itself. When the ulcerous processes have become advanced and aggravated, fever develops, the appetite is lost, and the animal grows so emaciated that death intervenes. In some cases that are left untreated recovery may follow slowly, but there is usually either a dense fungoid growth between the claws, a stiffening of the joints of the ankle, or a long fissured and misshapen hoof. When treatment is properly applied in the early stages of the disease it is usually cured within ten days. It is very rare for death to occur as a result of foot-rot, although in very virulent outbreaks involving 3 or 4 feet of each sheep the affection may terminate fatally within two or three months.

The course of the disease is also dependent upon the susceptibility of the affected animal. Thus it is a well-accepted fact that the pure breeds of fine-wooled sheep are especially susceptible to foot-rot, although the pure breeds of coarse-wooled sheep and the grades of both of these breeds of animals are by no means exempt. In the latter animals, however, the disease runs a milder course, and is more amenable to treatment than in the case of the fine-wooled sheep. Sex or age does not appear to have any important influence on the susceptibility of the animals, as the disease manifests itself quite generally in the flock, attacking alike male and female lambs, yearlings, and aged sheep.

INFECTIVE CHARACTER.

Some of the early writers seem to have been convinced that this disease was in no degree contagious, but at a later period many investigators opposed this opinion and strongly maintained that it spread from sheep to sheep by means of some contaminating agent which exuded from the erosions upon the affected feet.

In opposition to these statements many veterinary writers were positive in their declarations that the disease was never caused otherwise than by pasturing on low, swampy lands, or as a result of overgrown toes or by other conditions due to faulty care and surroundings.

But while the majority of writers seem to have denied that the disease possessed any contagious properties, there remained a very lively minority who entered a most vigorous protest against this view of its character, and who cited instance after instance in support of their claim that it was strictly of a contagious nature. They mentioned cases in which affected sheep had been brought from a distance and placed in flocks that had been sound and healthy for years, with the result that a portion of the flock soon became affected; also a case in which healthy and diseased flocks pastured in adjoining fields without any transmission of the trouble until a time when two or three of the sound animals jumped the dividing fence and grazed for the remainder of the day with the contaminated flock, with the result that they promptly contracted foot-rot. These writers recorded the infection of sound flocks as the result of their having been driven over roads which diseased sheep had traversed but a short time previously. Reports were made of test lots of sheep that were pastured for months on swampy and muddy lands without spontaneous development of foot-rot, which promptly became affected, however, on their removal from these pastures when inoculated on the skin between the claws of their feet with discharge from an affected foot. They mentioned several attempts at experimental inoculation with bits of diseased tissue, or with some of the moist excretions from an affected foot, which usually favored the investigator with successful terminations.

One of the best of these experiments was reported by Favré in 1823. He simply moistened the skin between the claws of 32 healthy sheep with matter obtained from diseased feet, with the result that 21 of them contracted the disease in consequence of this slight exposure.

Another convincing argument in favor of the dependence of foot-rot on a specific cause is found in the fact that young lambs yeaned by affected ewes have been known to show unmistakable symptoms of the disease as early as the sixth day after birth, and as this has occurred in flocks that have been closely stabled there remains no possi-

bility that the lameness of these lambs could have originated in swampy or muddy pastures.

Among the first experiments made by this Bureau, preparatory to the publication of this article, were some for the purpose of investigating the contagious nature of the disease. By means of careful tests performed with the purulent exudate from the feet lesions of these animals it was proved that foot-rot could be produced at will in healthy sheep not only by spreading a little purulent matter from a diseased foot upon the scraped interdigital skin of sound feet, but quite as readily when bouillon cultures inoculated with some of the discharge from an affected foot were applied in a like manner, even when the cultures used were of the third generation of the original growth.

It appeared from these experiments that the disease was dependent upon a specific organism for its existence, and that this organism could be readily perpetuated by the employment of the usual methods of bacteriological culture.

Microscopical examination of the purulent material discharged from the open sore of a case of foot-rot revealed, among other bacteria, the constant presence of long thread-like bacilli, which conform to the characteristics of *Bacillus necrophorus*, and which are capable, when brought in contact with the foot of a healthy sheep, of producing sores similar to those found in natural outbreaks of foot-rot.

Wherever it gains access to animal tissue it causes progressive degeneration and destruction, showing a tendency to spread in every direction from its first point of attack, and leaving behind as it advances a soft, dead, cheesy mass as the result of its poisonous effect upon all contiguous tissues.[a]

EXPERIMENT ON SHEEP.

The readiness with which the disease will spread from sheep to sheep, when the flock is kept under suitable conditions for such spreading, has been recognized for many years by sheep owners. In addition to the practical demonstration of its contagious character, which has been given in past years in nearly every sheep-growing State in the Union, many experiments have been made with the idea of determining the cause of the transmission of the disease from one sheep to another. For this purpose numerous direct inoculations with material from diseased feet have been made during this investigation, and in order to show the effect of pure cultures of the necrosis bacillus indirect inoculations have also been performed. A brief record of these two classes of experiments upon sheep will here be given.

Direct, by pus from affected foot.—Two sheep, Nos. 40 and 63, were

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[a] The bacteriology of this bacillus will be found on page 81.

inoculated on the scarified interdigital skin with some of the exuded matter from an infected foot, and developed the disease in typical form in seven days in each case.[a]

Sheep No. 313 was inoculated with discharge from an infected foot on the shaven surface of the cleft of its foot. This was followed by the appearance of a characteristic inflammation on the ninth day, and the inflammation gradually developed into the usual course of ulceration seen in this disease.

Sheep No. 108 was inoculated upon the shaven surface of the skin of the foot with discharge from a diseased foot, following which a protective application of moist sterile cotton and a linen bandage was applied. A characteristic case of foot-rot developed on the fourth day as a result. It seems probable that the early appearance of the disease in this instance was brought about by the partial exclusion of air and by the retention of more or less moisture upon the treated surface, through the agency of the cotton and bandage.

Lamb No. 94 is of special interest, having been born in an infected stall in December, 1901, and having continued until March 10, 1902, in daily contact with diseased sheep without showing the slightest evidence of lameness. During this period of exposure the stall in which the animals were confined was kept dry and clean. Had mud and moisture been present for the animals to walk about in, in common, the result would doubtless have been different. This test was continued for seventy-nine days, at the end of which time it was seen that the healthy lamb had received no degree of infection, although the disease had slowly continued to advance in the feet of its diseased companions until the affected members had become deeply eroded. Following this preliminary test, the lamb was directly inoculated, on March 10, by the application of material taken from a diseased foot to both of its feet on the right side. The interdigital spaces of both feet were scraped until the surface became blood tinged, when the watery exudate from the diseased foot of sheep No. 62 was smeared over the scraped surfaces. There appeared on both of these feet in fifteen days characteristic lesions of foot-rot, while the left hind foot also developed this disease from natural infection, although the lamb had previously withstood the danger incident to living in daily contact with diseased sheep. It may be stated in this connection that other negative results were also met with by exposing healthy to diseased sheep, but although seven such experiments did not produce the disease these can in no way offset the positive results obtained, considering that the exposure pens were always clean and dry and unlike the natural conditions under which infection usually spreads.

[a] In many cases where foot-rot was produced by inoculation antiseptic treatment was applied and a cure effected as soon as the disease had become characteristic.

Indirect, by cultures.—A review of experiments made with pure cultures of the bacillus of necrosis will serve to show the part which this organism is capable of taking in the development of foot-rot in sheep.

A pure culture of the bacillus was obtained from the liver of a rabbit, which was the third in a series inoculated from the foot of an infected sheep. This pure culture was then applied to the scraped surface of a healthy foot of sheep No. 87. The surface upon which the culture was placed began to show inflammation on the tenth day, appearing reddened and moistened and exhibiting the presence of considerable heat. For ten days more the irritation appeared to progress, until at the end of that time a painful ulcer, coated with a grayish-white exudate, had formed. Spontaneous healing commenced at this period, but its progress was slow, and microscopic examination of the watery exudation from the ulcerous opening taken nearly two months later showed that many of the long filamentous forms of the necrosis bacillus were still present in it.

Another healthy sheep, No. 88, was inoculated upon the scraped surface of its foot with the same material as that used in the preceding case. The response was much more prompt (four days) in this case, and the ulceration penetrated the tissues of the foot for about the same depth, while the final healing, which occurred by scab formation, required about the same length of time for its establishment.

A third sheep, No. 89, to which the bacillus was applied in a pure state, showed inflammation of the foot in a few days and by the eighth day was sore and lame as a result. The erosion penetrated beneath the skin of the heels, constantly excreting foul-smelling yellowish pus. Spontaneous healing began to make its appearance in about three weeks after the inoculation, and rapidly progressed to the complete restoration of the foot.

A fourth test of a similar nature gave much the same results, except for a slight loosening of the hoof from a portion of one of the toes.

From the very nature of the conditions surrounding a flock of sheep it must be known that a natural infection by *Bacillus necrophorus* in a pure state is an utter impossibility. There must of necessity be material contamination by various cocci and other bacteria from the floor of the sheep pens, or from muddy yards and runs. Many of these invading forms in all probability offer great assistance to the necrosis bacillus in penetrating normal tissue and in perpetuating and extending the disease.

The character and appearance of the material discharged from a foot inoculated artificially with a pure culture of the bacillus of necrosis indicate that there is a slight difference between the disease when

produced in this manner and the natural type. The same redness of the surface is noted and the same tendency to send deepening processes of ulceration and degeneration into the depths of the foot may be observed in both, but the discharge will be seen to consist largely of soft yellowish pus in those cases in which the foot has been inoculated with pure culture and the foot afterwards kept dry and clean, while in the natural infection under ordinary barnyard conditions and in cases produced artificially by the application of mixed bouillon cultures the exudate has more of a yellowish-gray watery appearance mixed with pus.

There is no noticeable difference in the odor of the affected feet whether the lesions are produced naturally or artificially, and the same disagreeable stench pervades all cultures made from them, especially after these cultures have grown for forty-eight hours or longer in the incubator; and it is a remarkable fact that the same odor may be detected lingering about the carcass of a rabbit which has succumbed to an inoculation with necrosis bacilli in all cases, whether the bacteria were derived from cases of foot-rot in sheep or from some other source.

The following experiments were made with tissue containing an abundance of necrosis bacilli and with mixed bouillon cultures made from the pus of affected feet.

Sheep No. 83 was inoculated under the skin of the heel with material taken from the center of a necrotic lesion in a rabbit that died as a result of the infection of the necrosis bacilli. Here the attack was prompt and serious. The animal was unable to use its foot by the third day, and this degree of lameness lasted fully a week. The organism penetrated beneath the hoof on each toe, causing it to be separated in each instance from the tissues beneath. A profuse discharge was constantly exuding from the point of inoculation, in which the long threads of the necrosis bacillus could constantly be demonstrated.

Sheep No. 102 was inoculated on the foot by the application of a mixed bouillon culture that had been taken directly from a diseased foot and grown in an incubator for forty-eight hours, at a temperature of 35° C. Foot-rot was well established in the foot by the sixth day following, and its course was rapid and acute.

Goat No. 71 was successfully inoculated by having the skin of its interdigital space bared by the clipping off of the hair and the exposed surface then smeared with mixed bouillon culture of the third generation. As a result of this procedure the disease made itself manifest on the ninth day, and followed a typical course through the various stages of inflammation, spreading ulceration and necrosis.

ECONOMIC IMPORTANCE.

Throughout the Middle West, where packing houses are located in many of the larger cities, the sheep-feeding industry has attained large proportions. At points situated within easy reach of the more important slaughtering centers stations have been established for the purpose of finishing off those sheep and lambs that have been shipped from the ranges farther west before they had reached a sufficient degree of fatness to admit their being dressed to advantage. The stations are located within easy reach of several of the more important stock yards, thus enabling the owner to take advantage of a favorable turn in market quotations, or to supply any shortage that may occur in the receipts of a particular grade of sheep at the yards with which he is associated.

There are several of these places with a capacity of over 50,000 sheep each, and one near Chicago that can accommodate 80,000, as will be seen by the following list of feeding stations, the total of which shows that 683,000 sheep can be finished for market at one time. This list does not include the vast numbers of animals that are fed in the feeding stations of the far West, nor those in bunches of 500 to 3,000, by private individuals throughout the Central Northern States.

Partial list of sheep-feeding stations in the United States.

Location.	Capacity.	Location.	Capacity.
Grand Island, Nebr	25,000	Plano, Ill	25,000
Norfolk, Nebr	25,000	Specht, Ill	25,000
Nickerson, Kans	25,000	Rochelle, Ill	20,000
St. Marys, Kans	25,000	Milldale, Ill	15,000
Hanover, Kans	8,000	Oswego, Ill	15,000
Columbus, Nebr	25,000	South St. Paul, Minn	40,000
Valley, Nebr	35,000	St. Anthony Park, Minn	60,000
Fremont, Nebr	25,000	Brighton, Minn	25,000
Stockdale, Ill	60,000	Trevor, Wis	25,000
Lafox, Ill	60,000	Total	683,000
Montgomery, Ill	80,000		
Kirkland, Ill	40,000		

It is customary to keep the animals closely penned during the period of their fattening at these establishments; in fact they are sometimes restricted to rather uncomfortably narrow quarters. They are divided into lots of 200 to 600, to suit the convenience of the feeder, and each lot is provided with a separate pen in which they remain from the time of their arrival until sufficiently finished to warrant the continuance of their journey to the packing house. In many cases their grain is supplied to them through "self-feeders," by which means a supply is kept constantly before them. Water is also available at all times, and the incentive to active exercise is very slight,

even if the pen were large enough to allow unrestricted movements. Under these conditions an outbreak of foot-rot quickly assumes serious proportions. While the disease will not of necessity spread from one pen to an adjoining one, there are several cases on record where the contagion has been so thoroughly disseminated among individual pens in which a few infected sheep have been placed that only a small number of its inmates escaped the attack. Inspectors of the Bureau of Animal Industry, United States Department of Agriculture, occasionally find an affected flock among the arrivals of sheep at the various railway terminals, in which the feet of as many as 75 to 80 per cent are diseased to a greater or lesser extent. These bunches of sheep have no doubt been run together in the feeding pens, and the percentage of diseased animals gives one a very good idea of the infectiveness of foot-rot under these conditions.

The sheep raiser or feeder who carries on his business upon a modest scale is often just as seriously injured by an outbreak of foot-rot in his flock as is anyone. His sheep run at will over a large portion of his farm, and it soon becomes so thoroughly contaminated by the repeated passage of diseased feet that the owner not only becomes thoroughly discouraged by the repeated failures of his attempts to eradicate the contagion from the premises, but his neighbors begin to look on him with suspicion, and in certain instances have become so aroused as to warn the unfortunate man against entering upon or crossing their holdings until he has succeeded in stamping out the dreaded plague.

The importer or breeder of choice registered sheep is frequently damaged materially by the appearance of this disease among his valuable animals. Foot-rot occasionally develops in sheep soon after importation from European countries in spite of careful examination at the time of purchase. In these cases it is probable that the virus had become lodged in some deep fissure under the horny covering of the foot during some previous exposure, and that it had remained latent in its hiding place until favoring conditions stimulated its growth.

Whatever the manner of propagating the infecting agent, the fact remains that foot-rot frequently manifests itself among flocks of blooded sheep while on shipboard on the way to this country, and conditions here favoring the spread of the infection from sheep to sheep, it is not uncommon for the animals of certain pens to show serious lameness by the time the port of debarkation is reached. Another place in which the owner of improved sheep expose his best specimens to more or less danger of infection is at the live-stock shows of the country, where his animals are exhibited side by side with sheep from widely scattered localities. This danger, however, is

reduced to a minimum by the excellent care given to both animals and pens while the exhibition is in progress. The greatest danger is probably met when the animals are loaded and unloaded over a chute at the railway station, which is used by all of the exhibitors in common.

The raising of Angora goats is also becoming an industry of great economic importance. Their value as producers of mohair, of fleece-bearing skins, and of meat, together with their efficiency as eradicators of brush and weeds, is bringing them into increasing favor with practical American people, while their beautiful silky coats and gentle dispositions make them very attractive as pets for those who seek to derive pleasure rather than profit from them. At the present time large sums of money are invested in these animals, and individual flocks numbering thousands of animals are not uncommon in some localities. An association of breeders has been formed which supports a registry book, and live-stock exhibitions at which the Angora forms a prominent feature are sure to attract general interest.

The experiments which have been made at this laboratory prove that Angora goats may readily be inoculated with foot-rot from sheep, and that where sheep and goats are allowed to pasture together they may be indiscriminately attacked by an invasion of this disease.

To what degree foot-rot exists among sheep and goats in this country can not be accurately stated, for the reason that our statistics are insufficient to furnish a basis for a reasonable estimate. Occasional outbreaks, especially the highly virulent ones, are reported, and in these cases about three-fourths of the flock become affected. Owing to the slow, protracted course of the disease and the length of time required for the affection to pass through a bunch of sheep, the losses occurring from the shrinkage of flesh in market sheep and from the diminution of the supply of milk for the sucking lambs of the affected ewes reach material proportions. In addition to these direct losses, the owner of an infected flock of full-blooded animals is subjected to discouraging failures in his attempts at selling off his surplus breeding stock, as buyers are naturally reluctant to introduce lame animals into their sheep-folds. The time and labor spent in the treatment of the feet of an infected flock should also be brought forward in this calculation of monetary loss.

DIFFERENTIAL DIAGNOSIS.

There are but few pathological conditions of the feet of sheep or goats that may be mistaken for contagious foot-rot. When lameness first makes its appearance in a flock there may some difficulty, how-

ever, in determining the exact nature of the trouble. Lameness may be primarily caused in these animals by wounds of the feet, by purulent inflammation of the interdigital space (so-called noncontagious foot-rot), by stoppage of the orifice of the biflex canal, by suppurative cellulitis (cutaneous abscesses), or by foot-and-mouth disease, and for a time the lesions produced by any one of these causes may offer a very confusing resemblance to those characteristic of the invading stage of foot-rot.

WOUNDS OF THE FEET.

Sheep may occasionally puncture the skin of the interdigital space by forcing a sharp stone or stub between the claws of the foot, but such accidents are infrequent, and the fever and lameness thus produced seldom last for more than a few days.

A more common cause of accidental lesions to the feet of sheep is found around some yards or stables, where loose boards with the points of nails sticking up from their surfaces are carelessly left for the flock to run over.

PURULENT INFLAMMATION OF THE INTERDIGITAL SPACE (FOULS).

This condition is one that is frequently met in sheep, and it has often been mistakenly called foot-rot. From this faulty naming has arisen much of the controversy over the question of the contagiousness of foot-rot. Parties who have had experience only with purulent inflammation of the foot, and who have looked upon it as foot-rot, have very reasonably asserted that foot-rot is by no means contagious, that it appears sporadically, may attack but few members of the flock, yields promptly to treatment, and nearly always makes its appearance among sheep during their pasturage upon low, swampy land. If the term foot-rot is used at all in connection with purulent inflammation of the feet, it should be qualified by calling the affection benign or noncontagious foot-rot, in order to avoid all confusion with the real or contagious form of the disease. This purulent inflammation may result from pasturing on wet, filthy grounds or on low, marshy lands. An irritation of the cleft of the foot occurs which is followed by fissures in the skin and a softening of the horn resembling foot-rot. In rainy weather sheep that are pasturing upon clay soils often accumulate irritating masses of twigs, stubble, or small, sharp pebbles in the interdigital space of the foot. These substances become thoroughly embedded in moistened clay, and this mixture is gradually molded to the form of the space between the claws of the foot. In this position it will remain for days unless removed by force, and it may be the cause of serious inflammation, suppuration, and lameness so long as it retains its position in this sensitive place. Each step of the animal

causes the projecting points of the offending material to cut deeper and deeper into the adjoining tissues of the foot. There ensues swelling above the coronet and the whole of this region becomes reddened and feverish. Cases have been noted where marsh grasses with their saw-like edges have become entangled in the cleft of the foot and have remained in position long enough to set up a painful irritation by their constant friction. Finally, on examining the foot of a lame sheep one may discover the presence of none of these pointed objects, and still the inflammation is intense. This condition has been known to follow the entrance of particles of sand and gravel into the cuts, cracks, or injuries, and one should always bear this in mind while looking for a cause for lameness, and carefully remove the grit or dirt which may be present. Sometimes the horn, having grown rapidly because of the unusual stimulation, may inclose the gravel and retain it within the foot as a constant source of irritation.

STOPPAGE OF THE BIFLEX CANAL.

Sheep and goats are provided with a secretory gland called the interungulate or biflex, situated among the tegumentary tissues of the leg just above the separation of the digits. The orifice of the little vessel that leads from this gland may be plainly seen upon spreading the toes apart. It occasionally happens that mud, sand, or some other gritty substance becomes forced up into the biflex canal and lodges there, not only choking up the excretory passage of the gland above, but also causing inflammation of the walls of the canal, which may develop into extensive suppuration and serious lameness.

This affection may be distinguished from contagious foot-rot by the fact that the ulceration does not tend to invade the tissues beneath the horny covering of the foot, nor does it assume an infectious character.

SUPPURATIVE CELLULITIS (CUTANEOUS ABSCESSES).

Stockmen whose sheep are obliged to pass daily through muddy yards or pens sometimes notice the eruption of sores, varying in size from the diameter of a millet seed to that of a silver dollar, just above the hoof, farther up on the ankle, or still higher up between ankle and knee.

The first indication of the trouble will be an erection of the hair over the affected area, quickly followed by swelling of the part, and accompanied with a marked rise of temperature in the animal, loss of appetite, sluggishness, and rapid wasting of condition.

As the disease advances each of the inflamed areas develops a typical abscess, containing creamy pus with a very offensive odor. Should any of these find lodgment in the tissues of the foot they may

be mistaken at first for indications of foot-rot, but the simultaneous appearance of similar abscesses beneath the skin of the leg will at once prove to the owner the nature of the trouble.

FOOT-AND-MOUTH DISEASE.

This country, most fortunately, has never experienced a serious outbreak of foot-and-mouth disease in sections in which the sheep industry forms an important factor in agricultural activities. It is one of the scourges of European countries, and the annual reports of outbreaks of contagious diseases in those lands show what a firm footing the disease has gained among their flocks and herds.

Should an invasion of this disease ever be mistaken for foot-rot in sheep, the illusion will not be one of long duration. The eruptions which appear upon the feet of sheep in an attack of foot-and-mouth disease may, during the invasive period of the outbreak, bear a close resemblance to those of foot-rot, but they are more superficial in their effect, being devoid of the deep-seated, erosive passages which characterize the foot-rot lesion, and for this reason they are far more transient, disappearing voluntarily when the disease has run its course in all cases in which the attack reaches a favorable termination. The lesions of foot-and-mouth disease are more plainly to be seen, the destructive processes frequently extending up above the cleft of the foot in front or rear into plain view of the examiner. In uncomplicated cases there is never any tendency to fungoid growths, and the structure of the hoof retains its normal formation and does not become soft or crumbling, as it frequently does after an attack of foot-rot. The primary attack of foot-and-mouth disease is usually evidenced by the simultaneous affection of at least three of the feet of the animal. The infection spreads more rapidly through the flock, and not to the sheep alone, but to the cattle and hogs which are permitted to mingle with them. In addition to the eruptions on the feet the sheep suffering from foot-and-mouth disease will occasionally show reddened patches upon the membranes of mouth and lips which speedily develop into blisters of varying sizes. The tongue may be affected in the same manner. These blisters soon rupture, leaving raw, open sores. The teats and udders of affected ewes are frequently the seat of like eruptions. The temperature of the animal shows marked elevation during the invasion of the trouble (106° F.), but this does not persist after the rupture of the vesicles. Lesions of the mouth are not as constant in sheep as they are in members of the bovine family.

A number of European writers have in the past insisted that contagious foot-rot of sheep does not exist independently of foot-and-mouth disease, but the very fact that contagious foot-rot has for

years been more or less prevalent among American sheep without ever having given rise to foot-and-mouth disease among the cattle and hogs of the same farms offers the most conclusive evidence that the diseases are independent of one another and that they have their origin in separate, specific organisms.

PREVENTION.

The prevention of foot-rot, a matter of absorbing interest to the sheep owner, may be successfully attained by means of careful management.

When purchasing sheep to be added to a healthy flock the buyer can not exercise too great caution in his examination of the newcomers, and to hold them for a few days in isolated quarters before permitting them to join the main flock may prove to be time and effort well spent. Another precaution which will in some cases prove beneficial may be found in the regular examination at stated intervals of the feet of each member of the flock and the removal of all excessive growths of horn. A large percentage of lameness in the horse is due to an "unbalanced foot," and the first step in treatment should always be the paring of the hoof, or the formation of the shoe in such a manner that the foot of the horse, while he is standing at ease, will be perfectly level in its relation to the floor surface upon which he is standing. The same rule holds good in an application to the ovine race. Overgrown hoofs should be so trimmed that the plantar or wearing surface of the foot will present a natural angle to the direction of the shaft of the leg, and all superfluous length of toe should be removed. Overgrown toes frequently tend to forcibly spread the hoofs apart, the tension thus produced leading in many cases to strained tendons and to lessening the natural resistance of the tissues of the region to injury.

A great amount of vital energy is unnecessarily expended in walking by a sheep with overgrown toes, especially if the animal is kept in yards or pens where cornstalks or other coarse litter are allowed to accumulate, or if it is pastured in stubble fields or where the grass has become long and tangled.

The heels of the hoofs seldom require any cutting, and the labor of trimming may consequently be entirely expended upon the toe. Soaking the feet for a time will be found to soften hoofs that are at first too hard to yield readily to the knife. It will be found satisfactory, where practicable, to select a time for trimming the hoofs when the flock may be brought up to the pens directly from an excursion through wet grass. The early morning, following a heavy fall of dew, is frequently selected for this purpose, or the work, if not neglected too long, may be deferred until a suitable rainy day.

Should the infection of foot-rot have been introduced into a sheep yard, trimming the feet will not prevent the spread of the disease, except as it indirectly assists nature in keeping the cleft of the foot free from dirt, and the wise shepherd will not relax his vigilance at the time of admitting fresh arrivals upon his premises, as it is at that time that he may most easily prevent the spread of this disastrous malady among his healthy animals.

Experience has shown that sound sheep may be safely pastured on land that has previously been occupied by sheep suffering from foot rot, provided that a winter's frosts have been allowed to intervene. The contagion of the disease seems to be effectively subdued by this means, and pastures that have become contaminated one season may be considered safe for their customary usage during the following season. The sheepfold, however, must be carefully disinfected to prevent the recurrence of the disease, as this bacillus will retain its virulence under suitable conditions in or around stables for several years.

The walls, racks, and troughs should be sprinkled with a solution containing 1 pound of pure carbolic acid to 5 gallons of water, to which enough lime has been added to make the sprayed area conspicuous. The manure and 4 inches of the surface soil should be removed and spread on a field that is to be tilled. In turning sheep on grass care should be taken to avoid low, marshy, or boggy lands, and to keep them, if possible, on high, dry pastures.

TREATMENT.

One of the first steps to be taken in the treatment of a flock of sheep affected with foot-rot is to separate all that are in any degree diseased from those that are healthy. After this has been accomplished much will depend upon the stage which the disease has reached among the animals of the flock in determining upon further action. Should the disease be in its earliest stage, with but few animals affected, it will doubtless be found sufficient treatment for those that appear sound to pass them through a shallow trough containing a solution composed of 1 pound of chloride of lime to each 12 quarts of water. This solution should have a depth of at least 4 inches in the trough, and the animals should be made to pass through it slowly, allowing time for the mixture to apply itself thoroughly to all the cracks and fissures of the feet. Instead of the mixture of chloride of lime, a solution composed of one part of carbolic acid crystals to every thirty parts of water, or 1 pound of pure carbolic acid to 4 gallons of water, may be used as a foot bath for the sound part of the flock.

The trough used in this operation may be of wood, tightly con-

Description of Plate 3.

Fig. 1.—Cover-glass preparation made from gelatin-agar colony obtained from the liver of a rabbit, which was the third in a series inoculated from the foot of an infected sheep. Stained with Loeffler's alkaline methylene blue. Camera-lucida drawing made with Zeiss No. 6 compensating ocular and 2 mm. oil immersion objective.

Fig. 2.—Liver of rabbit which died twelve days after the subcutaneous inoculation of *Bacillus necrophorus*. Stained with Loeffler's alkaline methylene blue. Camera-lucida drawing made with Zeiss 4 mm. objective and No. 6 compensating ocular. Notice the invasion of the normal liver structure by the necrosis bacilli arranged along the border of the necrotic focus.

Description of Plate 4.

Fig. 1.—Bouillon-agar culture (first dilution) of *Bacillus necrophorus*, showing 24-hour growth, with numerous small gas bubbles, but the colonies have not developed sufficiently to become visible.

Fig. 2.—Seven-day old bouillon-agar culture of this organism of the fourth dilution. The isolated colonies are characteristic in that their grayish centers are surrounded by fuzzy white areas, not unlike the strands of loose, fleecy cotton.

Fig. 3.—Single colonies of the necrosis bacillus, showing this filamentous character of their growth (enlarged about seven diameters).

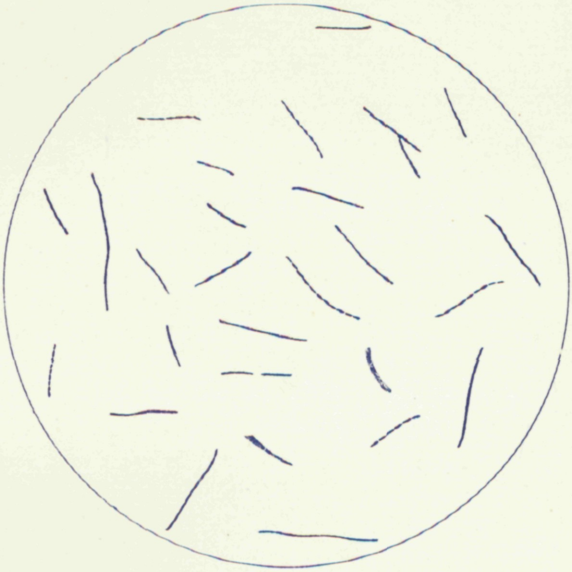

FIG. 1.—BACILLUS OF NECROSIS.

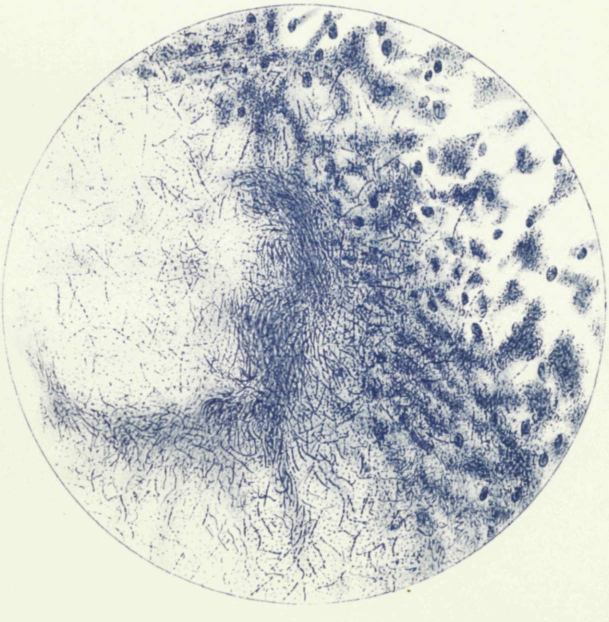

FIG. 2.—NECROTIC AREA IN LIVER OF RABBIT.

Haines del.

Breuker & Kessler Co. Phila.

FIG. 1.

FIG. 3.

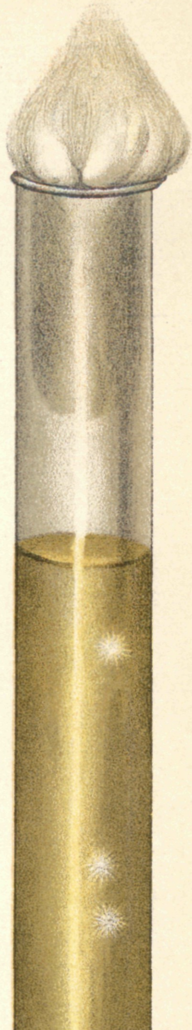

FIG. 2.

DEVELOPMENT OF COLONIES OF BACILLUS NECROPHORUS.

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BREUKER & KESSLER CO. PHILADA.

structed, 20 inches in width, and a foot or more in depth. The length should be proportioned to the size of the flock to be treated. For small lots that are accustomed to being handled, the trough need not be over 6 feet in length. In such cases, however, the animals should be allowed to stand for a moment in the solution before passing out. A greater length of trough would necessitate the preparation of a larger amount of fluid, and consequently would entail greater expense. Where a large number of sheep is to be treated the trough should not be less than 20 feet in length. Hurdles or portable racks may be so arranged by the sides of the trough and along the pathway leading to it that each animal will be obliged to pass through the bath with but little urging.

After this treatment has been applied to the sound part of the flock, they should be at once placed in fresh, uncontaminated quarters. Although they are not likely to show any evidences of the disease after being treated in this way, the owner or shepherd should not neglect them, but should closely watch for any signs of lameness, and when discovered the affected animals should be promptly removed and subjected to more careful treatment. In case the flock from which the healthy sheep were separated is badly diseased, it would be advisable to have the sound animals pass through the bath, as described above, on several occasions. This may be done every second day until three or four treatments have been applied, special care being taken in the meantime to provide fresh, clean quarters for the animals, completely separated from the diseased portion of the flock.

While selecting treatment for that portion of the flock in which the disease has become established, it should be remembered that the principal requisites are to lay bare the affected surfaces and to destroy the infectious matter which has lodged upon them. The remedy which will accomplish this most readily, and at the same time not give rise to harmful secondary conditions, is evidently the one that should be given the preference.

The bacteria, to which the disease is due, yield very readily to the application of disinfectants, and the trouble which so many sheep men have experienced in the eradication of foot-rot from their flocks must have been due to a failure to properly expose the affected surfaces to the action of the applied remedy.

During the present series of experiments many of the feet in which disease has been purposely produced have been healed up as soon as the true course of the affection had become evident, so as to avoid unnecessary lameness, and in these cases it has been found that all advance of the disease processes has promptly stopped upon the application of a 5 per cent solution of carbolic acid, several applications usually proving sufficient. In these cases, however, it

must be admitted that the conditions for successfully healing the lesions were far more favorable than those which surround the average diseased flock upon the farm. In the first place, the erosions had not extended very deeply into the foot, and, secondly, the animal was not allowed to run in a muddy yard, but was kept upon a dry stable floor. The instances serve to prove, however, that the remedy need not be very poisonous or caustic to produce the desired results, and to emphasize the fact that one must constantly aim, while treating foot-rot in sheep, to expose the diseased areas to the action of the disinfectant used.

Treatment of the affected animals should not be deferred, as more satisfactory results will be obtained by attacking the outbreak as soon as discovered than can be expected if the disease is permitted to spread among the flock or to penetrate deeper into the tissues of the affected feet. This is accepted as a very practical fact by the English shepherds, who attend shipments of thoroughbred sheep on their trans-Atlantic voyage to this country for breeding purposes. The statement is made by them that none but negligent or inexperienced shepherds will ever allow foot-rot to spread through a flock of which they are in charge, as thorough trimming and antiseptic treatment of the hoof of the first animals seen to be lame will surely save the balance of the sheep from an attack.

The treatment already suggested for the sound portion of the flock will be found very efficacious for early stages of the disease, but after the animal has become more seriously affected one should carefully examine each of its feet and, if necessary, pare away all shredded or loosened portions of the horny tissue. This will often prove to be a very laborious undertaking, but the operator should persist until the loosened horn has been thoroughly removed and all of the ulcerous fissures have been exposed.

The foot must be carefully cleaned and every portion of loosened and detached horn cut away, as the horny tissue once separated from the sensitive parts beneath will never unite with them again, but will remain as a source of pain and inflammation and also a protection for the disease-producing organisms while they attack and destroy the internal structures. Should fungoid granulations be met they should be removed with a knife or pair of curved scissors. All clippings and trimmings that are removed from the diseased feet, whether composed of bits of horn, shreds of tissue, or fungoid growths, should be carefully gathered up and burned or disinfected, as they may serve to spread the disease further if left where passing sheep may come in contact with them.

If this work has been thoroughly done, standing a sheep for ten minutes in a strong solution of copper sulphate (blue vitriol), made

as warm as can be borne by the hand, will in most cases effect a cure. This solution may be prepared by dissolving 3 pounds of copper sulphate in 5 gallons of warm water. The foot bath should be repeated if necessary.

An attendant should remain stationed by the side of each sheep whose feet are badly affected, to prevent the animal from lying down while it is in the copper-sulphate solution, as sheep of this class, because of the pain produced during their efforts to stand, are liable to drop to their kness, or even to lie down in the trough, during the application of the treatment. Soft bandages should be applied, after the sheep are removed from the foot bath, to all feet that have required deep cutting, not only for the purpose of protecting the sensitive tissue from becoming bruised, but in order that particles of dirt may be kept from the raw surfaces and that nature may be assisted in the formation of new protective coverings.

It sometimes happens that the disease assumes an aggravated form in several of the sheep, involving the deeper sensitive tissues and necessitating the application of hand dressings to the feet. In such cases all the loose and diseased tissue should be cut away and the affected parts washed thoroughly with a 5 per cent solution of carbolic acid. An antiseptic astringent powder, consisting of 4 parts of carbolic acid, 2 parts of tannic acid, and 94 parts of exsiccated alum, is then dusted upon the ulcerated surfaces and a bandage applied to afford the parts the desired amount of protection.

The most earnest efforts should be made to conquer the disease before the advent of warm weather, as it will be found more difficult to deal with during that period. On the contrary, cold weather and dry seasons are unfavorable for the development or spread of the disease, although they will not cure it.

THE ETIOLOGY OF HOG CHOLERA.[a]

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PRELIMINARY REMARKS.[b]

After the fundamental work of Salmon and Smith relative to hog cholera and the corroboration of their observations by so many other investigators it was regarded as settled beyond dispute that a certain microorganism, *Bacillus choleræ suis*, was the cause of hog cholera. Although certain results of the work of Salmon and Smith, as well as the experience of others, show that it is difficult to reconcile all the facts as found with the acceptance of this bacterium as the exclusive factor in the production of the disease, more or less plausible explanations of these discrepancies have been offered; but these explanations did not seem entirely satisfactory, as will be shown later. Since this is the case, since the etiology is incompletely understood, it is difficult to attack properly the important practical questions of prevention and cure. In the present investigations we believe that, although we have by no means exhausted the subject, we have been able to make some very significant observations which throw light upon the perplexing questions, and which we hope may eventually lead to a rational method of combating the disease.

In spite of the fact that the disease, hog cholera, is so well known, and that it has been so often defined and described in many excellent treatises, it will nevertheless hardly be deemed superfluous to state at

[a] This is a condensation of Bulletin No. 72 of the Bureau of Animal Industry.

[b] While attempting to produce an antitoxin for hog cholera by injections of cultures of *Bacillus choleræ suis*, Dr. E. A. de Schweinitz, working under the direction of Dr. D. E. Salmon, was led to question the correctness of the prevalent view in regard to the etiology of the disease. He instituted and carried out a number of experiments, most of which were directed toward the discovery of an animal parasite, the presence of which he suspected in the blood of sick hogs. His experiments were incomplete, however, and his sickness and subsequent death prevented further research on his part. While he was not actively concerned in the experiments described in this paper, we feel that but for the original skepticism on his part our work would probably not have been undertaken.

the outset just what our experience has taught us to regard as the essential features of the disease, on the one hand, and the variable and inconstant features, on the other. A definite statement in this regard is perhaps particularly called for, since all authorities do not agree upon the relative importance of the different manifestations seen in the disease. This discrepancy doubtless arises from the fact that in hog cholera, as in other diseases, in different outbreaks and at different times, one or the other set of symptoms and lesions predominate, and it is only by a study of various outbreaks in different parts of the country and over a long period of time that it is possible to arrive at an accurate knowledge of the variations to which the disease is subject.

In the definition and description of the disease given below we have endeavored to present our conception, derived from the earlier publications of the Bureau of Animal Industry and from other sources as well as from the experience we ourselves have had in more recent years.

THE NATURAL DISEASE, HOG CHOLERA.

Hog cholera is an acute and highly contagious disease which, so far as known, affects only hogs. It is characterized by fever, loss of appetite, weakness, and, where the affected animal does not quickly succumb, by rapid emaciation. Diarrhea is usually present, though the affected animal may be constipated. Epistaxis frequently occurs, and there is often a gluing together of the eyelids. In the most virulent forms of the disease especially there may be ecchymoses in the skin over the ventral surface of the body. These are usually in the form of discrete splotches, but at times the entire ventral surface is diffusely reddened.

The changes seen in the internal organs vary greatly even in different animals in one and the same outbreak in a given herd. In general these lesions may be said to be either those of a hemorrhagic septicemia or of an ulcerative enteritis, the latter particularly pronounced in the cecum and colon. The hemorrhagic lesions are characteristic of the rapidly fatal form of the disease known as "acute hog cholera," the ulcerative intestinal lesions being especially prominent in those outbreaks where the animals do not succumb so rapidly; both the ulcerative and hemorrhagic lesions may, however, be seen in the same animal. These two forms are not supposed to represent distinct diseases, but merely different types of the same disease, as already stated, the chronic form apparently resulting from either a decreased virulence of the infecting organism or a heightened resistance on the part of the animals which are attacked.

The lesions commonly met with are here outlined.

MORBID ANATOMY.

Subcutaneous areolar tissue.—When the skin of the thorax and abdomen is removed the subcutaneous areolar tissue may be found thickly dotted with ecchymoses of varying size.

Lymphatic system.—In acute hog cholera the inguinal glands on both sides are usually swollen and red, the hemorrhagic condition being so intense at times as to give the glands a bluish-black color. The lymphatic glands at the angles of the lower jaw may be affected in a similar manner, as may also the bronchial, mediastinal, mesenteric, mesocolic, retroperitoneal, and lumbar glands. In the chronic form of the disease the lymph glands seldom exhibit any change.

Heart.—This organ frequently presents on its outer surface, and also in the endocardium at times, hemorrhagic markings which vary considerably in their intensity in different cases.

Lungs.—The lungs, as a rule, are but slightly affected. In the acute form of hog cholera they often show ecchymoses of varying size on the serous surfaces; at times areas of broncho-pneumonia or collapse are met with.

Spleen.—In acute hog cholera the spleen, as a rule, is larger than normal, and engorged with blood, and may present numerous punctiform hemorrhages beneath the capsule, or larger hemorrhagic areas which are diffuse in character. In chronic hog cholera the spleen may be smaller than normal, and in this case the connective tissue is noticeably increased.

Digestive system.—(*a*) *Stomach.* The serous surface of the stomach may be flecked with diffuse hemorrhages, and the mucosa is not infrequently congested and inflamed. This inflammation is at times quite extensive, and may bring about a destructive ulceration of the mucous membrane. Small petechiæ may be seen here and there over the mucous membrane. (*b*) *Intestines.* In acute hog cholera the chief lesions found are ecchymoses in both serous and mucous coats, together with erosions of the mucous surfaces of both the large and the small bowels. The erosions in the cecum and colon appear to be the starting point of the button-like ulcers which are frequently encountered in the chronic form of hog cholera. These round ulcers vary from 1 to 2 mm. to several centimeters in diameter, and are elevated above the surrounding healthy mucous membrane. They are tough and hard, and their centers are usually dark greenish-yellow in color, and, in the case of the larger ulcers, all four coats of the intestine are involved. The ulcers are at times so numerous as to destroy the mucous membrane, or at least to affect it over extensive areas in the cecum and colon. (*c*) *Liver.* This organ may exhibit extensive fatty degeneration, with areas of coagulation necrosis or an

increase of connective tissue. In the acute form of hog cholera, minute hemorrhages may be visible beneath the capsule.

Kidneys.—In acute hog cholera the kidneys are practically always the seat of hemorrhagic changes, which vary more or less in extent. At times the cortices are intensely congested and all of the glomeruli are visible as minute deep-red points. In other instances the general congestion is absent, the major portion of the kidneys being rather paler than normal, dotted here and there with minute, sharply defined, punctate ecchymoses. At times the medullary portion of the kidneys is involved, and blood clots may be found in the pelves. In chronic hog cholera these ecchymoses are seldom seen.

Bladder.—Both the serous and mucous surfaces of this organ may be the seat of hemorrhagic changes, which vary considerably in extent in different animals.

In addition to the lesions which have just been described, nearly all of the serous membranes of the body, in the acute form of the disease, may be dotted with hemorrhages. The blood and internal organs of hogs which have died of either acute or chronic hog cholera usually yield pure cultures of a small, motile organism discovered by Salmon and Smith, and named by them *Bacillus choleræ suis.*

Hog cholera may be conveyed from sick to healthy animals almost if not quite without exception by contact, by feeding the viscera of diseased animals, and by the subcutaneous injection of the blood of sick animals. The disease may also be produced, according to Salmon and Smith, by feeding cultures of *B. choleræ suis* and by subcutaneous or intravenous inoculation of that organism. Welch and Clement claim that the disease may be produced by the intratracheal inoculation of healthy animals, as well as by intravenous inoculation with *B. choleræ suis.* Salmon and Smith found it very difficult to produce hog cholera by feeding or by subcutaneous injection of cultures of *B. choleræ suis*, but they consider that in certain instances they succeeded in doing so by both methods.

The mortality among hogs attacked by the disease varies from 30 to 100 per cent of the affected animals, the death rate from the acute type of disease usually exceeding 80 per cent of the affected herd.

THE INFECTIOUSNESS OF THE BLOOD OF ANIMALS AFFECTED WITH HOG CHOLERA.

It will be noticed in the brief description that we have just given of hog cholera that the statement is made that this disease is communicated readily to healthy animals by inoculating them subcutaneously with the blood of hogs suffering with spontaneous hog cholera. The infectious nature of the blood has long been recognized, Law [a] having

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[a] Ann. Rept. U. S. Com'r Agr., 1878, p. 377.

recorded experimental evidence of that fact in 1878. Other experiments showing the infectiousness of the blood of sick hogs are contained in the Bureau of Animal Industry report issued in 1889.[a] On page 110 of that report Salmon and Smith describe the inoculation of 4 hogs subcutaneously with the blood of hogs sick of hog cholera, 3 of the 4 inoculated animals dying as a result. We would call attention here to the striking difference between the readiness in producing the disease by the inoculation of blood from animals sick from the spontaneous disease, on the one hand, and the great difficulty experienced in producing the disease by subcutaneous injections of pure cultures of *B. choleræ suis*, on the other. This and other important differences will be fully discussed later.

It is suggested by Salmon and Smith that these successful results may have been due to the greater virulence of the organism in the blood, but they also suggest the possibility that the injected blood coagulating in the tissues protected *B. choleræ suis* from the injurious effects of the body fluids and from the attacks of phagocytes, and at the same time furnished the injected organisms with an abundant supply of suitable food. The bacteria being thus protected for a time might gradually acquire sufficient powers of resistance to enable them to enter the circulation and produce the disease.

At the outset of our present investigations it was deemed wise to repeat Salmon and Smith's experiments with the blood of diseased animals and to ascertain to what the pathogenic power of the blood was due. Accordingly, healthy hogs were inoculated subcutaneously with the blood of sick animals, the infection being derived from a number of separate and distinct outbreaks of hog cholera. We succeeded with the greatest regularity in communicating the disease to healthy animals by the subcutaneous injection of diseased blood obtained during the earlier stages of an outbreak. For convenience the blood was defibrinated previous to injection. It was also found that the clear serum which separated from the red cells in the bottles after the diseased blood was drawn under aseptic conditions possessed the power of inducing the disease in the same manner as the defibrinated blood. In the rare exceptions where the disease was not communicated in this way it was found that the animal that was injected possessed immunity, as proven by subsequent exposure to infection in a pen with animals sick of hog cholera; there was no exception to this. The subcutaneous injection of blood from diseased animals proved indeed to be such a convenient and reliable method of transferring hog cholera from one animal to another that we have used it almost exclusively for propagating the several strains of disease with which our experiments have been conducted. But while it is true we have

[a] Hog Cholera: Its History, Nature, and Treatment. Washington, D. C., 1889.

experienced no difficulty in thus propagating the disease with inoculations of blood, it should be explained that the different outbreaks which furnished the virus with which we have worked were selected because they appeared to possess a high degree of virulence. It is quite possible that in mild forms of the disease the same difficulty might be encountered in transferring the disease by blood inoculations as is found in transferring it by contact or by any other method.

What has been said above in regard to the result of inoculation with blood applies to blood obtained from animals at the beginning of an outbreak or during its height. Our own experience in propagating the disease by the successive inoculations of a number of hogs during a period of time covering several months has been that after a while the blood inoculations fail to cause the death of the animals. The virus seems to lose in potency after a number of passages through hogs.

The amount of diseased blood required to produce hog cholera when injected subcutaneously has not been definitely determined, but probably varies considerably, depending upon the virulence of the disease and the natural resisting power of the injected hog. We have produced the disease quite uniformly with from $\frac{1}{2}$ to 2 c. c. of blood, and in some instances with much smaller doses. For keeping the disease in existence, larger doses (5 to 10 c. c.) have usually been employed. This was done in order to avoid the loss of the disease through a possible lowering in virulence, the dose in most instances being no doubt much in excess of the amount required.

Our own experiments, therefore, support fully the statement in the Bureau of Animal Industry report [a] that this disease is readily communicated from diseased to healthy animals by the subcutaneous injection of blood from the diseased animals. The injections in our experiments were made with blood from five distinct outbreaks of hog cholera, and the results indicate, therefore, that the infectiousness of the blood upon subcutaneous injection is a character common to all outbreaks of acute hog cholera. Additional evidence of the infectiousness of the blood of animals suffering from hog cholera is afforded by the results of injections of unfiltered blood in connection with the experiments with filtered blood, described later.

Although we can not speak definitely, owing to lack of experimental data, as already stated, we would not expect the chronic form of hog cholera to be so readily communicated in this way. The lesions in the chronic form indicate a tendency toward a localization of the infectious centers in the intestines, whereas the acute form possesses the characters of a septicemia.

In addition to proving the ease with which hog cholera may be

[a] Hog Cholera: Its History, Nature, and Treatment. Washington, D. C., 1889.

transferred from one animal to another by the subcutaneous inoculation of blood, the inoculation experiments quoted indicate that this infectious property is not the result of the mechanical protection of *B. choleræ suis* by the clotted blood, the possibility of which was suggested by Salmon and Smith, as previously stated. All of our blood inoculations were made after the fibrin had been removed, the defibrinated blood containing corpuscles and serum, or the serum alone was used. The serum was diluted with ten volumes of sterile bouillon before injection and could not have afforded any mechanical protection from the phagocytes or other injurious agents. We must therefore look for some other explanation of the fact first observed by Salmon and Smith, namely, that hog cholera may be easily induced by subcutaneous injections of diseased blood, whereas the injections of pure cultures of *B. choleræ suis* in the same manner fail, in the great majority of cases, to produce disease.

THE CONTAGIOUSNESS OF THE NATURAL DISEASE, HOG CHOLERA.

In connection with the infectiousness of the blood of hogs affected with hog cholera, the readiness with which transmission of the disease takes place by simple contact with diseased animals, or by exposure in infected pens, must be taken into careful consideration. This high degree of contagiousness of hog cholera is universally recognized by the farmer as well as by those who have made experiments to test the point; for aside from the abundant evidence of contagiousness to be derived from the records of natural outbreaks of hog cholera, such as the accidental introduction of a sick pig into a healthy herd, we would call especial attention to certain records contained in the Bureau of Animal Industry report.[a] On pages 145 to 153, inclusive, of that report will be found the records of a number of hogs that had been subjected to various methods of treatment, the object of the treatment being to render them immune from hog cholera. An examination of those records will show that the treated animals and controls were subsequently placed in infected pens to determine the value of the immunizing agent, and that after such exposure to the natural disease, 30 out of a total of 33 that were exposed died of hog cholera. These figures include the check animals which were exposed with the treated ones.

We are in possession of the records of a large number of recent experiments which confirm in every way the evidence cited above, and we would emphasize the importance of this contagiousness as a necessary feature of the disease.

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[a] Ibid.

IMMUNITY IN HOGS WHICH HAVE RECOVERED FROM HOG CHOLERA.

Hogs that have recovered from natural attacks of hog cholera are immune from subsequent attacks. This fact is quite generally known among hog raisers and causes the average farmer to place a higher value upon these so-called "cholera-proof" hogs than upon nonimmunes. During the course of experimental work in the past few years we have had the opportunity of observing the course of a large number of separate outbreaks of hog cholera, and have tested by means of field exposure and by injections of diseased blood, the immunity of a number of animals that recovered from these natural attacks, but have never seen one of them succumb to a second attack. Immunity acquired in this way seems to be remarkably high in degree and very permanent. The same thing has been found to be true of hogs which have recovered from the disease produced by subcutaneous injections of hog-cholera blood, such animals being found immune from hog cholera when exposed to the disease in a natural way and also when injected subcutaneously with blood from diseased animals.

A point of especial interest which was fairly well brought out by our experiments is that a severe attack of hog cholera is not necessary for the production of immunity from subsequent attacks. In fact, the protection derived from a mild attack appears to be quite as complete and lasting as that afforded by a severer form of the disease. That this immunity is not transitory is shown by the fact that we have been unable to induce the disease in some of these immunes by injections of diseased blood made nearly a year after recovery from the original attacks.

RECAPITULATION OF THE CHARACTERISTICS OF HOG CHOLERA.

Before proceeding to a description of the various methods we have adopted in our efforts to reproduce hog cholera artificially, we wish to bring together in concise form those characteristics which appear to be essential before any disease may be classified as hog cholera, without, however, offering them as a means of differential diagnosis.

(1) The lesions found at autopsy should be those commonly met with in either acute or chronic hog cholera, and which have been already fully described.

(2) The disease should be contagious, as proven by intentional exposure of healthy animals placed in the pen with sick ones or by the history of an outbreak.

(3) The blood of diseased animals should be capable of producing an attack of hog cholera when injected subcutaneously into healthy hogs.

(4) Animals which have recovered from an attack of hog cholera should possess immunity when exposed to natural infection or when

injected subcutaneously with the blood of hogs suffering from hog cholera.

The lesions found at autopsy are variable. This variability of the pathological lesions is seen during the course of practically all outbreaks of hog cholera. In some animals there is almost complete absence of lesions; in others there may be few or many of the lesions so generally regarded as pathognomonic of that disease. The hog may be desperately sick, and yet when killed the autopsy may reveal only a few reddened lymphatic glands and possibly a few hepatized areas in the lungs; or, on the contrary, every organ may show pathological changes. Without evidence of contagiousness and without the postmortem examination of other hogs from the same herd, some of the animals could not be said to have died of hog cholera. On the contrary, the contagiousness, the infectiousness of the blood, and the acquired immunity after recovery are very constant features.

EXPERIMENTS WITH PURE CULTURES.

Having become impressed with the constancy of the three characteristics which were found in all natural outbreaks of acute hog cholera studied by us, and finding after an examination of the literature upon the subject that the questions of the contagiousness of the disease and the infectiousness of the blood in animals injected with pure cultures of *B. choleræ suis* had apparently not been made the subject of experiments in earlier investigations, we determined to make a certain number of experiments which would be in a way supplementary to those already recorded by Salmon and Smith and by Welch and Clement, and which would at the same time enable us to compare the results obtained with the blood and tissues of hogs suffering from hog cholera, on the one hand, with those obtained with cultures, on the other; in short, to see whether hog cholera with the three essential characteristics of contagiousness of sick animals, infectiousness of the blood of sick animals, and immunity when exposed to spontaneous infection after recovery, is found in the disease produced by cultures.

In making these experiments some hogs were injected subcutaneously, others intravenously, and others were fed.

The results of the subcutaneous inoculation of hogs with cultures of *B. choleræ suis* showed that such inoculations produce serious disease in a relatively small number of cases. Of the 19 hogs injected subcutaneously, only 3 died from the inoculation. Salmon and Smith also encountered this difficulty in producing disease by subcutaneous inoculation, but seemed to regard this as being due to lack of virulence of the organism. This explanation is hardly satisfactory in our cases, for the organisms were very virulent for rabbits and guinea pigs, and produced death in hogs with great uniformity when

injected intravenously even in minute amounts, besides producing disease and death when fed to hogs in very small doses. So there can be no doubt as to the virulence of the cultures employed. The fact already brought out, that the injection of blood serum of hog-cholera hogs produces disease promptly and uniformly, suggested the trial of additions of normal defibrinated blood to cultures for subcutaneous inoculation; but the injection of cultures mixed with defibrinated blood proved to be as little efficacious in producing disease as the injection of cultures alone.

The intravenous injection of even very small amounts of culture produced fatal disease with great regularity, as already stated, and the feeding of cultures frequently caused sickness and death.

In these experiments, then, *B. choleræ suis* was constantly fatal to hogs when administered intravenously, and usually so when administered by mouth, but not so as a rule when injected subcutaneously.

The symptoms produced by the organism when fed are those of intestinal disturbance mainly; the symptoms after intravenous injection are profound depression, loss of appetite, with death in a few days. The autopsy in both cases frequently shows hemorrhagic lesions in the kidneys and other organs, and greater or less necrosis and even ulceration of the mucosa of the intestines, particularly of the cecum in the region of the ileocecal valve, the intestinal lesions being more marked where cultures are fed. So far, then, as symptoms and lesions are concerned, the disease in hogs produced by *B. choleræ suis* may very closely resemble those found in natural outbreaks of hog cholera. At least we are unable to make out any essential differences between the two diseases in these respects. But in certain other very important respects there exists a most striking difference; for, while the disease contracted by natural infection is highly contagious and the blood of animals sick from natural infection is almost always infectious for other hogs by subcutaneous inoculation, and, moreover, while hogs recovered from disease contracted in a spontaneous outbreak possess a high degree of immunity from subsequent infection, all these features are wanting in the disease produced by cultures of *B. choleræ suis*.

The lack of contagiousness in the disease produced by *B. choleræ suis* is rather surprising, for it would be natural to suppose that hogs made sick with the cultures would readily communicate the disease, particularly in those cases accompanied by the profuse diarrhea which is often seen, notably in those where the hogs have been made sick by feeding cultures; yet in only one case—and that not free from objection—was there any indication that healthy hogs contract disease by associating intimately with hogs sick from cultures of *B. choleræ suis*. The hog which became sick from association was in the pen with a

hog sick from the subcutaneous injection of a culture of *B. choleræ suis.* In this case the symptoms, which developed in seventeen days, were those of a passing sickness, shown by diminution of appetite and a gluing together of the eyelids, but all symptoms subsided in three or four days. This animal afterwards survived exposure in a pen with hogs sick of the natural disease. So, while it can not be asserted positively that this animal was not made sick by contact with the culture-injected hog, there are several considerations which make this at least improbable, for a hog inoculated with blood drawn from the tail of the culture hog remained well after the inoculation and did not acquire immunity, as was shown by the death of the hog in the exposure pen. Again, a hog fed viscera of the culture-injected hog became somewhat sick from eating the viscera, but also failed to acquire immunity. So, if of the 2 hogs—the one inoculated with blood and the other fed with the viscera of the culture hog—neither became immune, then it is not probable that a hog could have acquired immunity from simple association.

There were 21 hogs in all exposed to hogs which were given cultures of *B. choleræ suis* by different methods of administration, and only 1 of the 21 showed any signs of sickness. Of these 21 hogs exposed to culture hogs, 18 were subsequently placed in a pen with hogs suffering from natural hog cholera, and 16 of the 18 contracted the disease, showing that all except 2 of the 18 hogs were susceptible, and would have contracted the disease from the culture animals if these had been suffering from infectious hog cholera as we understand the disease. Of the 2 hogs remaining well in the exposure pen, 1 has been discussed above, where it is shown that the animal probably did not derive immunity from the sickness contracted while in the pen with the hog made sick by inoculation with a culture, but in all likelihood possessed natural immunity. The most reasonable explanation of the failure of the other one of these hogs to become sick in the exposure pen is also that the animal had natural immunity, since it showed no evidences of sickness in the pen with the hogs inoculated with cultures, and one of these became sick and died in the exposure pen after recovering from the sickness produced by the culture. The companion of the latter hog died from the effects of the inoculation with the culture.

The injection of blood from a hog suffering from the natural infection is uniformly followed by the disease. This is the experience of all who have tested it, and we have abundant experimental proof of this fact. Indeed, we use this means of propagating the disease for experimental purposes in preference to any other on account of its certainty, as already stated. The injection of blood from animals sick from the administration of cultures, on the contrary, did not produce disease in any of the 11 hogs inoculated in this way. Of these

11 hogs, 10 were exposed to natural infection, 9 became sick, and 7 died. This, again, is in marked contrast with the natural disease, for, in the rare instances of recovery after inoculation with the blood from a hog suffering from hog cholera, there is almost, if not always, without exception, the production of immunity.

Finally, the administration of cultures of *B. choleræ suis* seems to have little, if any, effect upon the production of immunity from natural infection. Incidentally, this has been shown above, in connection with the discussion of the power to produce disease with cultures; but it is worthy of more than passing mention, since it constitutes such a marked contrast with the results following recovery from the spontaneous disease and from inoculations with blood from hogs suffering from the spontaneous disease.

There were 18 hogs which survived the administration of cultures; 16 of these were injected subcutaneously and 2 fed. Of these 18 hogs 16 died, 1 became sick but recovered, 1 remained well when exposed to natural infection. Of these 2 which survived, both had previously been made sick by subcutaneous injections of cultures. Of the 16 that contracted hog cholera and died in the exposure pen, 6 had recovered after being sick from subcutaneous injection of cultures, 2 from feeding, and 8 had shown no sickness from the administration of cultures.

The difference between the disease produced by *B. choleræ suis* and spontaneous hog cholera, in respect to the immunity of hogs which recover, is very marked, for it can not be admitted that even the hog which failed to become sick in the exposure pen derived its immunity from the administration of cultures, since it may be claimed with equal probability that this animal had natural immunity. Indeed, it seems more probable that the latter explanation is correct, in view of the many instances in which illness after administration of cultures failed to produce immunity.

It is clear, therefore, that while the disease produced experimentally with cultures of *B. choleræ suis* corresponds in some respects with spontaneous hog cholera, the two diseases show marked points of difference. They differ in contagiousness, infectiousness, and in the production of immunity from natural infection in animals that recover.

As an explanation of these differences between the natural disease and that produced by *B. choleræ suis*, the possibility that they could be accounted for by a sudden and profound alteration in the disease-producing properties of *B. choleræ suis* occurred to us. But this did not seem probable, for the reason that many cultures employed in the foregoing experiments were tested only a few days after isolation from the body of the sick hog; moreover, these same cultures proved

to have retained full virulence for guinea pigs and rabbits after cultivation for several months.

But if these conflicting results between the natural disease and that produced by *B. choleræ suis* are not due to a rapid change in virulence of the organism for hogs, they must be due to the presence in the blood of some agent which is absent from the pure cultures, and which, acting either alone or in conjunction with *B. choleræ suis*, is able to bring on a typical attack of hog cholera.

In order to determine the presence or absence of this hypothetical virus in the blood of hogs sick from hog cholera, it became necessary to see whether we could obtain infectious blood from which *B. choleræ suis* was absent.

Two methods of obtaining such blood were finally adopted. The first was based upon the supposition that if two microorganisms were concerned in the production of hog cholera they would probably not always invade the body simultaneously. Hence, by drawing blood from hogs at different stages of the disease we might be able to find a time during the illness when *B. choleræ suis* would be absent and the hypothetical virus would be present in the blood.

EXPERIMENTS WITH DISEASED BLOOD FREE FROM B. CHOLERÆ SUIS.

In order to obtain blood from the same hog on a number of consecutive days, we have used a very ingenious method which was devised by Dr. W. B. Niles. In hogs the superficial blood vessels are either so small or are so situated that it is impracticable to use them for obtaining blood by the methods ordinarily employed. Doctor Niles found that by cutting off the end of the tail an abundant supply of blood could be obtained, and, in addition, the blood drawing was comparatively simple and did not cause serious injury to the hog.

The general plan adopted for carrying out these so-called "tail-blood" experiments was as follows: A hog known to be healthy was injected subcutaneously with blood from a sick animal. Beginning forty-eight hours later, blood was drawn from the tail of the injected hog; a certain amount of the blood obtained in this way was injected subcutaneously into a healthy hog, and an equal quantity placed in neutral beef broth and incubated, the culture being made in order to determine whether or not *B. choleræ suis* was present. The object of these experiments was to determine whether the time at which the blood becomes infectious coincides with the appearance of *B. choleræ suis*, or whether this is independent of the appearance of that organism.

There was one contingency which it was feared might interfere with this experiment. In injecting the original hog with diseased blood the chances were in favor of *B. choleræ suis* being present in

the injected blood. Under such circumstances it was feared that this organism would invade the body immediately and thus defeat our object. However, as no better method appeared available at the time, the experiments were conducted according to the plan described above, and the results showed that our fears were groundless, for *B. choleræ suis* did not appear in the general circulation until several days after the hogs were inoculated.

Two experiments were carried out according to the plan just outlined. In the first experiment the blood was infectious on the second day, whereas *B. choleræ suis* did not appear till the third day. In the second experiment the blood was infectious on the second day and *B. choleræ suis* did not appear until the fifth day. Beyond question, then, the blood of hogs suffering from cholera may be infectious for other hogs in the absence of *B. choleræ suis*, as is shown from the results given above. Even if we had only the results in these two cases this conclusion would not be unjustifiable, but when it is supported by the evidence of the filtration experiments below it becomes unavoidable.

We have laid the emphasis which the matter deserves upon the contagiousness of the natural disease as contrasted with the lack of contagiousness in the disease produced by the use of cultures of *B. choleræ suis*, and it would complete these experiments with the tail blood taken from sick hogs if it could be shown that hogs made sick by the injection of blood devoid of *B. choleræ suis* could convey the disease to other hogs by association; but this matter was overlooked at the time the experiments were conducted. Still, since it will be shown in connection with the filtration experiments that those hogs inoculated with blood free from *B. choleræ suis* suffered from a highly contagious disease, it is but reasonable to suppose that the disease produced by the injection of tail blood, in all other respects resembling that produced by the filtered blood, should correspond with this in contagiousness as well.

EXPERIMENTS WITH FILTERED BLOOD.

In addition to the experiments with the blood drawn from the tail during life, a second plan adopted was the filtration of diseased blood through Berkefeld and Chamberland cylinders. The filtration experiments were in part conducted before the tail-blood experiments; but for a better understanding of the results it has been deemed best to group all experiments of that character together.

It may be well, before entering upon a description of the filtration experiments, to explain briefly the conditions under which they were performed. First of all we would emphasize the fact that the most rigid precautions against accidental infection were adopted in all

cases. All pens had wooden floors. The disinfection of pens and feeding troughs was in every instance most thoroughly carried out; the attendants in feeding the experimental animals never entered the pen, nor was any implement used for cleaning the pens without thorough disinfection both prior to and after use. The large majority of all hogs in these experiments were held in quarantine several weeks, and where such a quarantine was impracticable the animals were obtained from farms which were personally known to be free from disease. As a result of a rigid enforcement of these precautions there have been in the course of our experiments only a very few instances of disease that could be attributed to accidental infection. Any doubtful cases of this character have been left out of our report or else the conditions have been thoroughly explained.

In the foregoing pages it will be noted that we have insisted upon contagiousness as a necessary feature of hog cholera, and yet in some of our filtration experiments pen checks were not used, and therefore the contagiousness of the disease in such instances was not established. In explanation of this it should be remembered that our conception of the disease hog cholera has been more or less modified by the results of our experiments; hence in the earlier work some details were omitted which were later found to be desirable. In work of this character, even with all possible facilities at our command, we have not failed to encounter difficulty in making each experiment absolutely complete within itself; but when the work is considered as a whole, we believe the sources of error have been eliminated so far as possible, and the results show very satisfactory uniformity.

The experiments were made with eight distinct strains of disease. A part of the experiments were conducted at Washington, D. C., and a part at a temporary station in southwestern Iowa. In obtaining virus from natural outbreaks for experimental purposes we have selected those instances of disease which showed unusual virulence and which would be classed as "acute hog cholera." The filters used were Berkefeld laboratory cylinders Nos. 5 and 7 (normal) and "Filtres Chamberland, Système Pasteur," marked "F" and "B," and all filtrations were, of course, conducted with sterile apparatus.

The serum was drawn off with a sterile pipette after the defibrinated blood had stood for twenty-four hours or more in the refrigerator. The actual amount of serum used in most cases was 50 c. c., though in some cases a smaller amount of serum was used, as it was not always possible to obtain 50 c. c. free from red blood cells. The serum was then diluted with neutral beef broth or physiological salt solution in the proportion of 1 part of serum to 10 parts of the diluent. The dilution was made for the reason that experience had taught us that the undiluted blood serum filtered very slowly, and in order to

facilitate the passage of any virus that might be present. In most cases a fresh bouillon culture of about 4 or 5 c. c. of *B. prodigiosus* was added to test the efficiency of the filtration. The vacuum employed varied from 22 to 25 inches, and the time of filtration was usually very short, about a half hour or less, though at times it was much longer on account of the presence of red blood cells. The apparatus was arranged in some cases so that the filtration took place from within the cylinder outward; in other cases from without inward.

The hogs used in the experiments were young animals weighing from 20 to 40 pounds, and the injections were made inside the thighs, using, as a rule, 22 c. c.—11 c. c. on each side—equivalent to 2 c. c. of undiluted serum.

Twenty-four separate experiments were carried out. In most of them hogs were inoculated with unfiltered as well as with filtered blood or serum, and uninoculated healthy hogs were placed in the pens with the inoculated ones to serve as checks on the contagiousness of the disease. In some of the experiments the serum from sick hogs was passed through a Berkefeld cylinder, in others through a Chamberland F or Chamberland B, and in a few instances different portions of the same serum were passed through each of these, but there was no appreciable difference in the effect of these filters, for the results of the subcutaneous injections of hog-cholera blood filtered through Chamberland and Berkefeld cylinders showed that these injections produced disease quite as uniformly as those with the unfiltered blood. On the whole, it is true, hogs inoculated with the unfiltered serum became sick more quickly after inoculation than the hogs inoculated with the same serum after filtration, but this was not always the case. It is also true that a greater percentage of deaths occurred among the hogs inoculated with the unfiltered serum than among the hogs inoculated with the filtered serum. Of the 36 hogs inoculated with the unfiltered serum, all became sick, 24 died, 10 were killed in a moribund condition, and 2 recovered; while of the 61 hogs injected with filtered serum, 58 became sick, 39 died, 10 were killed in a moribund condition, 9 recovered, and 3 showed no perceptible sickness. So, although the mortality was less in the hogs injected with filtered serum, there was practically no difference in the production of disease in the case of unfiltered and of filtered blood, for the 3 hogs which failed to show noticeable symptoms of sickness after the injection of filtered blood must have possessed great resisting power, since 2 of them remained well on exposure to natural infection, and the other lived for many weeks in contact with sick hogs, but died eventually, though it is not certain that death was due to hog cholera.

The resisting power of these 3 hogs may have been natural, or, as will appear from what is said later on, it may have been acquired

from the serum injections. The possibility that they may have been really sick but not have shown visible evidences of this should not be lost sight of.

It is not surprising, however, that the blood after filtration should show less potency than blood before filtration, for, whatever the nature of the infectious agent, it is but natural to suppose that some of it is removed by the filter. Nevertheless, diminution of potency is not observed in all cases, as already remarked, and when no diminution is observed it is probable that there is such a large amount of the infectious agent present originally that although a part is removed by filtration there still remains a sufficient amount to cause disease.

It will be observed that these results show not only that the filtered blood produces disease with great regularity, but that hogs which recover from the disease produced in this way have immunity from natural infection. Of the 9 hogs that recovered after being sick, only 1 died in the exposure pen, but from the history of this case it seems probable that this hog may not have fully recovered from the sickness produced by the filtered serum.

The results furthermore show that the disease produced by injection of filtered blood is contagious; for uninoculated hogs placed in the pens with the hogs inoculated with the filtered blood remained well until the inoculated animals became sick, and then contracted disease more or less promptly. There were 22 such check hogs in the pens with the hogs inoculated with filtered serum, and 17 of the 22 contracted the disease, while 5 did not show noticeable symptoms of illness.

Of the 17 that became sick, 14 died, 2 were killed in a moribund condition, and 1 recovered and remained well on exposure to natural infection. Of the 5 which showed no disease from association, 1 remained well in the exposure pen and the others died. So the disease produced by the filtered blood proved contagious in at least 77 per cent of the cases, and four of the five failures may possibly be accounted for by the fact, which can be verified from the records, that the disease in the inoculated animals to which these checks were exposed was of a mild type. The other failure was probably a case of natural immunity, since the hog did not contract the disease on exposure to natural infection.

The experiments made to test the infectiousness of the blood and tissues of animals sick as a result of the inoculation of filtered blood showed that the blood of such animals is infectious and that the viscera cause the disease on feeding. The urine was tested and found to be infectious in one case. This urine contained *B. choleræ suis*, but, since this organism does not appear to affect the virulence of the

blood, it could hardly be regarded as the cause of the pathogenic property of the urine.

It is evident that there is no essential difference between the disease produced by filtered diseased blood, on the one hand, and that acquired in natural outbreaks, on the other. The symptoms and lesions differ in no particular in the one case from those in the other; but still more striking and convincing evidence of identity is the fact that hogs recovered from sickness produced by the filtered blood have immunity from the natural disease.

We would emphasize the fact that the filtered blood was shown to be free from *B. choleræ suis* by culture tests in all cases, and by the inoculation of rabbits or guinea pigs in most cases.

GENERAL CONCLUSIONS.

We have called attention to the fact that acute hog cholera—at least the form of that disease encountered in southwestern Iowa—possesses, in addition to those symptoms and lesions generally recognized, certain other essential features which have not been considered as fully in previous work as, in our opinion, their importance deserves. These features upon which we wish to lay especial stress are:

(1) Contagiousness: The disease should be communicable from sick to well animals by association.

(2) Infectiousness: The blood of sick animals should cause disease upon subcutaneous injection into healthy nonimmunes.

(3) Immunity: After recovery the animals should resist subsequent exposure to the disease.

Our experiments have shown that pure cultures of *B. choleræ suis* injected subcutaneously into hogs usually produce but slight disturbance, although after intravenous injections or feeding a severe illness frequently results. The disease produced in this manner may present the symptoms and lesions seen in acute hog cholera, but does not possess the characteristics of contagiousness nor of infectiousness of the blood; nor are those hogs which have recovered from such illness immune when exposed subsequently to the natural disease. In regard to the experiments with pure cultures of *B. choleræ suis*, therefore, we may say that they demonstrate the very considerable pathogenic power which that organism possesses for hogs, but they also show that the disease produced by that organism lacks several of the essential features of acute hog cholera.

The experiments with blood serum derived from hogs sick of hog cholera and proven to be free from *B. choleræ suis* show, on the contrary, that such serum produces illness in hogs with great regularity upon subcutaneous injection, and, furthermore, that the disease thus produced possesses all of the characteristics of the natural disease,

including symptoms, lesions, contagiousness, infectiousness of the blood, and immunity in those animals which recover. These results are in such striking contrast to those obtained when cultures of *B. choleræ suis* are used, and they are in such perfect harmony with those obtained by the use of unfiltered blood from sick hogs, that we are forced to conclude that there exists in the blood of hogs suffering from acute hog cholera some virus other than *B. choleræ suis*, and that this virus is necessary for the production of that disease.

This virus, present in the blood of hogs sick from acute hog cholera, but absent from pure cultures of *B. choleræ suis*, is known to us only by the effects it produces. We have failed completely in all attempts to discover by microscopic examination or by the usual cultural methods any visible microorganism in these filtrates. That the pathogenic power of the filtered blood is due to some living agent endowed with the power of reproduction, and not to the presence of a toxine alone, there can be no doubt, from the fact that the disease induced by the filtered serum is communicated from sick to healthy animals by association, and, moreover, from the fact that we have transferred the disease induced by filtered serum to a second and even a third animal by subcutaneous injections, the serum being filtered each time previous to inoculation.

While our experiments establish beyond question that the filterable virus was present in all the outbreaks of hog cholera studied experimentally by us, it is also true that *B. choleræ suis* was present almost as uniformly. So it would be impossible to overlook, even if we were inclined to do so, the part which this organism may have played. But from the results of our inoculations with the filterable virus on the one hand and our results and those of others with cultures on the other, we are compelled to conclude that the prime cause in our cases was the filterable virus, and that *B. choleræ suis* was at most an accessory factor.

The exact rôle played by *B. choleræ suis* in outbreaks of acute hog cholera is difficult to define. That the fatal result in many instances is materially influenced by the presence of that organism can not be doubted, and in addition we would emphasize the fact that although the filterable virus appears to have been the primary invader in those cases of acute hog cholera which we have studied, we do not deny the possibility of independent disease being caused by *B. choleræ suis*. In fact, it is difficult to avoid a belief in such a possibility on account of the very considerable pathogenic power for hogs exhibited by many cultures of that organism when fed or administered intravenously. The filterable virus seems not only to cause disease by itself, as shown by the results of many of our experiments, but it seems also to be able to lower the resisting power of the hog

and thus enable *B. choleræ suis* to invade the body, and this, we believe, takes place in the majority of cases in natural outbreaks. If the filterable virus is capable of lowering the resisting power of hogs for *B. choleræ suis*, then it is easily conceivable that other agencies may also lessen the resisting power of these animals.

So it must be admitted that a disease in hogs may exist which is due to *B. choleræ suis* and having no connection with the filterable virus found by us in the outbreaks we have studied. From the knowledge we have of the pathogenic powers of *B. choleræ suis*, however, we would expect that any disease in which it is the chief pathogenic factor would be possessed of a low degree of contagiousness.

The fact that *B. choleræ suis* was found in a large proportion of the cultures taken from hogs inoculated with filtered serum seems to indicate strongly that this organism has its normal habitat on or in the bodies of healthy hogs, and that in the case of lowered resistance on the part of the hogs this organism enters the circulation. A careful study of the bacterial flora of the hog's alimentary tract might throw considerable light upon this subject.

We have begun investigations of this nature, but as yet other more pressing work has prevented their completion. In a few preliminary examinations guinea pigs and rabbits were inoculated subcutaneously with small amounts of the intestinal contents of normal hogs and a few agar plates were made from the same material. In one case only, when the method of Drigalski and Conradi for the isolation of typhoid bacilli was used, did we succeed in discovering an organism which possessed the cultural characters of *B. choleræ suis*. The only way in which this organism from the normal intestinal contents differed from the classical type of *B. choleræ suis* was in its lack of pathogenic power for guinea pigs. It will be readily understood that the isolation of *B. choleræ suis* from material containing an immense number of colon bacilli is a matter of unusual difficulty, and it is therefore not surprising that we should fail to discover it, even though it may have been present in very considerable numbers. The isolation of a nonvirulent form of *B. choleræ suis* from the intestines is, therefore, considered very important on account of the support it lends to the hypothesis that *B. choleræ suis* may be frequently an inhabitant of the intestine of the normal hog.

If such a hypothesis be true, the conditions would be entirely analogous to those under which many pathogenic microorganisms exist, as, for example, the pneumococcus in the mouths of healthy individuals, and the swine plague bacillus (*B. suisepticus*) on the tonsils of healthy hogs, and in the pens where healthy hogs are kept,

the supposition being that microorganisms present in small numbers or possessing a low degree of virulence are successfully resisted until certain influences either heighten the virulence of the bacteria or lower the resisting power of the animal body. The production of disease by feeding small quantities of *B. choleræ suis* might seem to indicate that this organism could not remain in the hog's intestine without giving rise to more or less serious disturbance, but it should be remembered that these small quantities of culture ($\frac{1}{10}$ to $\frac{1}{2}$ c. c.) contain enormous numbers of bacilli and probably many more than the hog under ordinary circumstances is able to resist.

The toxin present in artificial cultures may also play some part in causing illness when cultures are fed, or it may be—and this last supposition seems not unlikely—that *B. choleræ suis*, if it exists in the bodies of normal hogs, possesses a very low degree of virulence, and that it is only through a lowered resistance on the part of the hog that it is enabled to enter the circulation and cause disease. The isolation from a healthy hog of an organism indistinguishable from *B. choleræ suis* except by absence of pathogenic power for guinea pigs lends strength to the explanation last mentioned of the way in which hogs are liable to attacks by *B. choleræ suis*. *B. coli communis* is a familiar example of an organism constantly present in health, and yet assuming under certain conditions very great pathogenic power.

Whatever may be the port of entry or the influences which bring about an invasion by *B. choleræ suis*, we are convinced that the filterable virus was responsible for the high degree of infectiousness and, therefore, for the spread of the disease encountered in the several outbreaks of acute hog cholera described in previous pages of this bulletin. It seems reasonable to suppose that what has been found to be true in these eight outbreaks is also true of other epidemics of acute hog cholera, and therefore that the extensive losses occasioned by outbreaks of that disease are to be attributed, in the main, to the filterable virus. In many of the individual hogs the fatal termination may have been in large measure due to *B. choleræ suis*, but the probabilities are that, without the filterable virus, comparatively few hogs would have been attacked.

It follows from all that has been demonstrated in the preceding pages that if a practical method of protecting hogs from the filterable virus should be discovered the problem of combating hog cholera, at least the highly infectious form of that disease, will have been solved.

Description of Plates 5, 6, and 7.

Plates 5, 6, and 7 show the lesions in the lung, kidneys, cecum, and inguinal gland of hog 1262, which was inoculated with filtered serum. The hemorrhagic lesions are well brought out, but the other portions of the several organs are paler than usual, owing to the fact that hog 1262 was bled to death, and also because the organs were kept in a preservative solution for several days before being drawn, the preservative tending to extract some of the coloring matter.

Part of Lung of Hog 1262, injected with filtered serum.

Breuker & Kessler Co. Philad^a

KIDNEYS OF HOG 1262, INJECTED WITH FILTERED SERUM.

BREUKER & KESSLER CO. PHILADA

Cecum and Inguinal Gland of Hog 1262, injected with filtered serum.

Breuker & Kessler Co. Philada.

EXPERIMENTS CONCERNING TUBERCULOSIS.[a]

Part I.—THE VIRULENCE OF HUMAN AND BOVINE TUBERCLE BACILLI FOR GUINEA PIGS AND RABBITS.

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For these experiments 9 cultures of *Bacillus tuberculosis* were isolated from as many different cases of human tuberculosis. Five of these were obtained from adults and 4 from children, and, for comparative examinations, 1 culture of bovine tuberculosis was isolated from a cow suffering from tuberculosis contracted in a natural way. In addition to the 10 cultures just mentioned, 2 others—one of human and the other of bovine origin—were employed. These two cultures had been cultivated artificially for many generations. A short history of each of these cultures will be found in Part II (see p. 175), but for the sake of convenience a brief description of each is given below.

THE CULTURES.

The cultures used in this work were all obtained from guinea pigs, and all were freshly isolated with the exception of human No. 50 and bovine III. The guinea pigs were inoculated subcutaneously with bits of tissue from the various cases of tuberculosis, except in the case of the two animals from which the sputum cultures were obtained. The latter were inoculated intraperitoneally.

(1) *Culture F T, human.*—Obtained from the lung of a guinea pig which had been inoculated with sputum from a 45-year-old woman suffering from pulmonary tuberculosis.

(2) *Culture F L, human.*—Obtained from the spleen of a guinea pig which had been inoculated with sputum from a 40-year-old man suffering from pulmonary tuberculosis.

(3) *Culture S E No. 3.*—Obtained from the spleen of a guinea pig inoculated with a small fragment of the lung of a 50-year-old man who had died of generalized tuberculosis.

(4) *Culture G D, human.*—Obtained from the spleen of a guinea pig which had been inoculated with a small fragment of a peritoneal

[a] This article is condensed from Bulletin No. 52, Parts I and II, of this Bureau.

tubercle from a 19-year-old man who had died of a generalized tuberculosis.

(5) *Culture 12124, human.*—Obtained from the spleen of a guinea pig which had been inoculated with a small fragment of the lung of a 27-year-old woman who had died of tuberculosis, the autopsy showing extensive tuberculous disease of the lungs and tuberculous ulceration of the intestines, with swelling of the mesenteric glands.

(6) *Culture C No. 1, human.*—Obtained from the spleen of a guinea pig which had been inoculated with a small fragment of a mesenteric gland from a 19-months-old child that had died of a generalized miliary tuberculosis, together with extensive ulceration of the large and small intestines.

(7) *Culture D T, human.*—Obtained from the spleen of a guinea pig which had been inoculated with a small fragment of the lung of a child that had died of a generalized tuberculosis.

(8) *Culture E T, human.*—Obtained from the spleen of a guinea pig which was inoculated with a small fragment of a mesenteric gland from a 12-year-old girl who had died of an intestinal and peritoneal tuberculosis.

(9) *Culture C No. 4, human.*—Obtained from the spleen of a guinea pig which was inoculated with a small fragment of a peritoneal tubercle from a child of 5 years of age that had died of a generalized tuberculosis.

(10) *Culture No. 50, human.*—Obtained from the spleen of a guinea pig which had been inoculated with a bit of spleen from a tuberculous baboon. The baboon was inoculated with a human culture which had been under cultivation in this laboratory for a long time, a history of the culture not being available.

(11) *Culture C No. 81, bovine.*—Obtained from the spleen of a guinea pig which had been inoculated with a fragment of a mediastinal gland from a cow suffering from tuberculosis; natural infection.

(12) *Culture III, bovine.*—Obtained from the spleen of a guinea pig which had been inoculated with a small fragment of the lung of a tuberculous baboon. The baboon had been inoculated with a small amount of bovine III (Smith) tubercle culture. This culture had previously been grown for some time on bouillon in addition to having been cultivated on blood serum for a number of generations before reaching our hands.

CULTURAL CHARACTERS.

The cultural and morphological characters of the various organisms were studied at the same time that the animal inoculations were made. For comparative examinations, cultures were chosen which

were of the same age and which had been grown under identical conditions upon the same lot of culture media.

A careful examination of several series of cultures on hardened egg made it possible to separate them into groups. The differences observed were slight, however, and it is possible that a more prolonged cultivation might obliterate entirely the dividing line.

Group I (consisting of cultures E T and C No. 4, human; C 81 and III, bovine) was characterized by the very scanty growth, by the fact that the colonies in cultures from guinea pigs were quite small and flat and tended to coalesce, and by the physical condition of the growth, which was moist and glistening in fresh cultures. A portion of the growth could be easily removed with a platinum loop and brought into a state of fine subdivision in bouillon.

Group II (consisting of human cultures F T, F L, S E No. 3, G D, 12124, C No. 1, D T, and No. 50) exhibited usually, in original cultures, round, distinctly elevated colonies, and in subcultures the growth was more abundant than in the cultures of Group I. It was dry, rather difficult to remove with a platinum wire, and not infrequently exhibited a sheen on the surface. The growths of this group on egg were brought into a fine state of subdivision with considerable difficulty, it being practically impossible to get rid of the many small flakes, which clung together and could not be broken up. Smith noted, in regard to serum cultures of his bovine and human organisms, that the bovine cultures could be brought into a finer state of subdivision than the human cultures.

The microscopic characters of the several organisms when cultivated on egg did not show sufficient variation to allow a distinction to be made between them. The bovine bacilli were indistinguishable from the majority of the human bacilli.

Cultures of the different bacilli on dog's serum did not show sufficiently constant variations to permit of a separation into two groups, as was the case with the egg cultures. Three of the cultures—E T, C No. 4, human, and C No. 81, bovine—which were examined at intervals during their cultivation on dog's serum, did not exhibit any marked differences. The organisms in C No. 4 were slightly longer from the first than those in the other two cultures, but, as will be noted later, the greater length of the bacilli in this case was not accompanied by a lower virulence.

GUINEA-PIG INOCULATIONS.

All of the guinea pigs which were used in the experiments were as vigorous and healthy as it was possible to obtain them. None had ever been used for any other purpose, and, after inoculation, they were kept in perfectly clean, separate cages, one guinea pig usually

being placed in a cage with a rabbit which had received the same culture. The animals were not handled after inoculation, the main reliance being placed upon the length of life and the result of the macroscopic and microscopic examinations after death. The heaviest guinea pig weighed 664 grams and the lightest 424 grams; the average weight being 532 grams. All guinea pigs were inoculated subcutaneously on the inner side of the thigh. The doses given were as nearly uniform as it was possible to make them, the culture being prepared for inoculation in the same manner as that used by Smith, which is as follows: Particles of the culture were carefully transferred from the culture tube to the inside of a dry sterile test tube until enough was obtained to make the desired amount of suspension. By the use of a heavy platinum wire having a flattened spatula-like end, the clumps of bacilli were rubbed against the sides of the tubes until all were broken up and the bacilli smeared in a thin film on the glass. A small amount of sterile peptonized bouillon was now added, and by means of the platinum wire the culture was mixed thoroughly with the fluid. More bouillon was added until the required dilution was obtained. I have adopted for all inoculations a suspension which was made as nearly as possible equal in density to a twenty-four hour typhoid culture. A uniform dose of 0.5 c. c. was used. For the sake of obtaining a better comparison in the discussion of these results, the various cultures have been divided into three groups. It must be understood, however, that this grouping is made in order that the results may be more clearly explained and not primarily on account of their different effects upon guinea pigs. A few of the guinea pigs died within less than two weeks after inoculation, and, unless these animals showed sufficient tuberculosis to account for their death, they were not taken into consideration in computing the average length of life.

Group I, bovine cultures C No. 81 and III.—The guinea pigs inoculated with these cultures had an average weight of 542 grams and lived after inoculation an average of twenty-three and two-thirds days.

Group II, human cultures E T and C No. 4.—The guinea pigs inoculated with these cultures had an average weight of 565 grams and lived an average of twenty-two and one-fourth days.

Group III, human cultures No. 50, F L, S E No. 3, G D, 12124, C No. 1, and D T.—The guinea pigs inoculated with this group of cultures had an average weight of 530 grams and lived an average of thirty-five and one-half days.

It will be seen that in the case of the animals inoculated with Group I (bovine cultures C No. 81 and III) and Group II (human cultures E T and C No. 4) the differences in the length of life after inoculation were so slight that no separation based on this point

would be possible. If anything, the human cultures C No. 4 and E T might be considered slightly more virulent; for, although the guinea pigs of this group averaged 23 grams heavier, they lived an average of one day less.

The cultures of Group III were distinctly less virulent for guinea pigs than those of Groups I and II, the animals having survived an average of twelve days longer than the bovine guinea pigs which were of greater average weight.

The similarities between Groups I and II and the differences between these and Group III appear also in the results of the post-mortem examinations.

The spleen, liver, and lungs are the organs which are principally affected in guinea pigs, and when the inoculation has been made subcutaneously on the inside of the thigh the lungs are the last of those organs to exhibit signs of the disease. For this reason the time required for the lungs to become involved may be taken as an index of the rate of progress of the disease, and I have therefore considered the tuberculosis as generalized only when the lungs as well as the liver and spleen are affected.

In the case of the animals inoculated with cultures of Group III, the disease was generalized in all of those which survived thirty-one days or more. In those which survived longest the characteristic yellowish areas in the liver and the tubercles in the lungs were largest and most numerous, and the spleen was also most extensively diseased. In the case of those animals inoculated with the cultures of the Groups I and II the disease was generalized in all those which survived more than twenty-three days. None of the animals inoculated with these cultures lived more than twenty-eight days, and only in those which survived the inoculation the longest were the large, yellowish, bile-stained areas in the liver very prominent. That organ, while showing in those which died first some such changes, had usually the appearance of having undergone very rapid degenerative changes, which, while just as extensive, had not developed so far as in those animals of Group III which lived for a longer time.

The impression conveyed, therefore, by the macroscopic appearance at the autopsies on guinea pigs was that the disease induced by the cultures of Groups I and II was more rapid in its progress than that induced by the cultures of Group III, and that death resulted from the extensive interference with the functions of the various organs before the tuberculous process had really reached its height. In the case of Group III the disease seems to have been disseminated less rapidly, the organs being able to perform their functions less perfectly, of course, but sufficiently long for the tubercles to reach a further stage of development.

In the microscopic examination of the tissues special attention was

paid to the following points: (1) The number and size of the tubercles; (2) the condition of the tubercles, whether they showed necrosis of the center and whether there were any evidences of retrogressive changes indicating decided resistance on the part of the body to the invasion of the tubercle bacillus; (3) the number of tubercle bacilli in the lesions.

First of all it may be stated that, in the microscopic as in the macroscopic examinations, no essential difference in the nature of the pathologic changes could be noted in the different guinea pigs. The differences observed were only such as are always found in tubercles which have reached varying stages in their development. The histologic changes in the organs of animals inoculated with cultures of Groups I and II were practically identical in those animals which survived approximately the same length of time, while in those animals inoculated with Group III, and died at the end of the same number of days, the lesions were always less advanced, about 8 days longer being required for cultures of this group to produce lesions approximating those produced by Groups I and II.

In none of the guinea pigs were the lung tubercles sufficiently far advanced to show a characteristic necrosis of the central portion, although in a few instances its begininining was indicated by a fragmentation of the cell nuclei. The liver and spleen in all the inoculated guinea pigs contained tubercles with characteristic central necrosis and usually in the liver the hepatic cells outside of the zone of the tubercles showed greater or less degenerative changes, indicated by obliteration of the nuclei and a fatty degeneration. In the spleen the tubercles were not well defined, there being found, as a rule, large irregular areas of coagulation necrosis. Tubercle bacilli were most abundant in these necrotic areas.

Tubercle bacilli were much more abundant in the tubercles in those guinea pigs inoculated with the cultures of Groups I and II than in those inoculated with any of the members of Group III. There were no constant differences between the bovine cultures C No. 81 and III, on the one hand, and the human cultures C No. 4 and E T, on the other. In the sections tubercles would occasionally be found after inoculation with the bovine cultures, which contained more tubercle bacilli than certain tubercles in guinea pigs inoculated with C No. 4 and E T, and the exact reverse was occasionally noted. Such differences, however, were not marked, and no distinction, based on the number of bacilli in the tubercles, could be made between bovine cultures C No. 81 and III, on the one hand, and human cultures C No. 4 and E T, on the other.

As a result of the guinea-pig inoculations just described, the following conclusions may be formulated, although they are based upon

such slight differences that the distinctive features might be entirely obliterated by a series of experiments in which the animals used were appreciably lighter or where the dose of culture was appreciably greater:

(1) There was a sufficient variation in the virulence of the human cultures for guinea pigs to permit of their provisional separation into two groups.

(2) In those animals inoculated with the most virulent group of human cultures the disease was marked by its rapid progress (death in less than thirty days) and by the relatively greater number of tubercle bacilli in the lesions.

(3) There were no differences observed in the effect produced on guinea pigs by the two most virulent human cultures and the two bovine cultures. In both the disease was rapid in progress and in both tubercle bacilli were very numerous in the lesions.

(4) As a general proposition it may be stated that in the case of guinea pigs weighing over 400 grams and inoculated subcutaneously with 0.5 c. c. of a suspension having a density of a twenty-four hour typhoid culture, a difference of from 100 to 150 grams in weight did not appear to influence the length of life of the animals.

RABBIT INOCULATIONS.

In the experiments with rabbits the cultures were prepared for inoculation in the same manner as in the guinea-pig experiments. A uniform dose of 0.5 c. c. was used, but in this case all inoculations were made into an ear vein. No rabbits weighing less than 1,350 grams were used, and after inoculation they were not disturbed, no attempt being made to take temperatures or to weigh the animals. In all cases where duplicate inoculations were made the animals inoculated with the human cultures had a greater average weight than those inoculated with the bovine cultures.

As a result of these inoculations it was found that the various cultures could be readily separated into two groups, the separation being based upon the length of life and the gross lesions observed at the autopsy. The cultures of Group I, consisting of bovine cultures C No. 81 and III and human cultures C No. 4 and E T, caused the death of all rabbits within twenty days, the autopsy always revealing a severe generalized tuberculosis. The rabbits inoculated with the cultures of Group II, on the contrary, lived an average of one hundred and five and three-fourths days (one animal inoculated with culture C No. 1 was living at the end of a year). Five rabbits of this group died within forty-eight days after inoculation, 2 of them succumbing on the twenty-seventh day. The rabbits of this group which succumbed before the forty-eighth day presented a very much

less severe tuberculosis, however, than those inoculated with Group I. The gross lesions observed in the rabbits inoculated with the cultures of Group I presented at death a typical picture of a severe, rapidly progressive miliary tuberculosis. The lungs were literally filled with minute tubercles 1 mm. or less in diameter, most of which showed a distinctly white necrotic center. The lungs did not collapse when the chest cavity was opened, the disease being so extensive that the lungs were almost completely solidified. The liver was rather large, and minute grayish points could usually be seen scattered over its surface. The spleens of all the animals were much enlarged, being usually from two to four times the normal size, and having scattered over their surfaces minute grayish areas, which were frequently so numerous as to give a steel-gray color to the organ, which, owing to the congestion, would otherwise have been dark red. The kidneys frequently showed on their surface numerous small grayish points quite similar to those seen on the liver and spleen.

The severe involvement of the lungs and spleen was always visible after inoculation with any member of Group I. The liver and kidney lesions were not always to be seen, but they were present in at least one of the animals inoculated with each of these cultures. With respect to their virulence for rabbits and the gross lesions produced, there was no observable difference between the human cultures C No. 4 and E T and the bovine cultures C No. 81 and III.

The cultures of Group II (consisting of cultures F T, F L, S E No. 3, G D, 12124, C No. 1, D T, and 50) showed sharp differences from Group I in the lesions which they produced, although there were considerable variations in the individual rabbits inoculated with the members of Group II. As has been remarked before, the rabbits inoculated with Group II had an average life of one hundred and five and three-fourths days, against an average of less than twenty days for those inoculated with Group I. Certain of the rabbits of Group II, however, survived only twenty-seven days, and in all 5 died within forty-eight days. As the pathologic changes noted in those rabbits of this group which died before the forty-eighth day differed markedly from those seen in the rabbits which had survived a longer time, it will be better to consider the gross changes induced by Group II in two subgroups. Those rabbits of the first subgroup which succumbed within forty-eight days presented at the autopsy lesions which were very slight when compared with those produced by Group I and which did not seem sufficient to cause death. Indeed, the early death in 2 of the 5 cases might be attributed to a coccidium infection which was present in the livers of both. As to the lesions of tuberculosis seen, all of the 5 rabbits agreed fairly well. The lungs showed slight changes. Sprinkled over their surface were a number of small grayish, almost invisible points, usually not more than 0.5

mm. in diameter. These minute foci showed no coagulation necrosis, and were apparently not numerous enough to interfere seriously with the normal functions of the lung, for the tissue outside of the minute tubercles appeared to be perfectly healthy, the lungs collapsing normally when the chest cavity was opened. These areas in the lungs correspond closely with those described by Smith for his sputum rabbits. They become white and plainly visible when immersed in alcohol. In a few of these rabbits some minute grayish points could be seen on the surface of the liver. The spleen and kidneys were normal in size and appearance. Those rabbits inoculated with Group II and which lived a longer time (forming the second subgroup) exhibited lesions which differed markedly from those noted in the rabbits which died at an earlier date, and they were also separated sharply in their macroscopic characters from those produced by Group I. In the rabbits of this latter subgroup, all of which lived more than seventy-nine days, there was extensive involvement of the lungs and kidneys. In the lungs there were large white irregular areas of coagulation necrosis, some having a diameter of 1 cm. The necrotic areas were so extensive as necessarily to interfere seriously with the function of the lungs. In some of the rabbits which lived the longest a softening had taken place in the necrotic areas, and abscesses were produced which contained a rather soft white pus. The liver and spleen in all these animals were apparently normal, while the kidneys were, without exception, extensively diseased, showing on the surface and in the body of the organ white necrotic areas of varying size, some of which had softened.

A careful histologic examination was made of the lungs of all the inoculated rabbits, and, in the case of most of them, the liver, spleen, and kidneys were also studied. As a result of this microscopic work it is again possible to separate the various cultures into two groups. The lesions caused by Group I were characterized by the distinct necrosis of the central portion of even very young tubercles and by the very great number of tubercle bacilli in them. In the lungs the bacilli were present in enormous numbers. This group (I) comprises bovine cultures No. 81 and III and human cultures E T and C No. 4.

The cultures of Group II are the remaining human cultures. In those animals which died within seven weeks necrotic changes were absent, the tubercles being marked by an accumulation of epithelioid cells; occasionally giant cells could be seen. Tubercle bacilli were usually scarce, only a few being visible in each nodule. The tubercles were fairly numerous in the lungs, but very scarce in the liver, spleen, and kidney. In those rabbits which lived more than seven weeks the necrotic changes were marked, involving large areas, but the tubercle bacilli were not numerous, except in those areas which

had broken down. There they were usually present in considerable numbers.

To recapitulate, the intravenous inoculation of rabbits served to separate the cultures into two groups. Group I (human cultures C No. 4 and E T and bovine cultures C No. 81 and III) caused the death of the rabbits within twenty days, due to a severe generalized tuberculosis, a necrosis of the central portion of the tubercles being marked and large numbers of tubercle bacilli being present in the lesions. Group II (human cultures No. 50, F L, F T, S E No. 3, G D, 12124, C No. 1, and D T) caused the death of rabbits after an average of one hundred and five days. Those rabbits which died in less than forty-eight days did not show sufficient tuberculosis to cause death; necrosis was practically absent and very few tubercle bacilli were found. Those that lived longer than forty-eight days showed extensive necrotic changes, but in most of the tubercles very few bacilli could be seen.

From the results of the rabbit inoculations which have just been described the following conclusions may be drawn. It must be remembered, however, that they are based upon results obtained when the rabbits weighed over 1,300 grams and when the dose was the same as that already noted. Any considerable variations in either of these two factors might modify the results considerably.

(1) Mammalian tubercle bacilli may be divided into two classes: (*a*) Those which cause the death of rabbits in twenty days, due to a severe generalized tuberculosis, and (*b*) those which kill only after several months, or when an earlier death takes place the lesions produced are not severe and necrotic changes are conspicuous by their absence.

(2) The lesions resulting from the inoculation with the virulent cultures are characterized by their wide distribution, rapid necrosis, and by the very great numbers of bacilli in the lesions.

(3) The lesions resulting from the inoculation with the less virulent cultures are characterized by the absence of necrosis in the tubercles in those rabbits which died within seven weeks and by the large conglomerate tubercles with extensive necrosis seen in those rabbits which survived for a longer time. Tubercle bacilli were found usually in very small numbers.

(4) Tubercle bacilli of bovine origin, in their action upon rabbits, were indistinguishable from the most virulent human cultures (E T and C. No. 4).

GENERAL CONCLUSIONS.

The foregoing experiments have been especially striking on account of the widely varying virulence among the human tubercle cultures, and by reason of the fact that those human cultures showing

the highest degree of virulence were indistinguishable from the bovine cultures with which they were compared. It is also interesting to note that those human cultures which were identical with the bovine cultures in their virulence for rabbits were also capable of causing a generalized tuberculosis in calves, (see Part II) and in addition, only those cultures which caused the death of rabbits within twenty days were capable of bringing about a generalized tuberculosis in calves after subcutaneous inoculation. There seems to be no reason whatever for making a distinction between the two bovine cultures and human cultures C. No. 4 and E T in so far as their effect upon guinea pigs and rabbits is concerned, and as a result of our experiments the following general conclusions seem unavoidable:

(1) Certain tubercle bacilli of human origin are indistinguishable either culturally, morphologically, or with regard to their virulence for rabbits and guinea pigs from certain tubercle bacilli of bovine origin.

(2) There is considerable variation in the virulence of human tubercle bacilli for rabbits and guinea pigs.

Until we know what influence a residence in the human body exerts upon bovine tubercle bacilli we can not determine accurately the proportion of cases of human tuberculosis which result from infection from cattle.

I am inclined to the belief, from the experiments here presented and from those of Ravenel, Vagedes, Fibiger and Jensen, and others, that in bovine and human tuberculosis we have to do with organisms differing usually in virulence, but between which there is no other essential distinction.

More detailed study of tubercle bacilli derived from accidental inoculation of men with bovine virus is needed, together with a more extended examination of bovine bacilli derived directly from cattle.

Part II.—THE COMPARATIVE VIRULENCE OF HUMAN AND BOVINE TUBERCLE BACILLI FOR SOME LARGE ANIMALS.

By E. A. de Schweinitz, Ph. D., M. D.; M. Dorset, M. D., and E. C. Schroeder, M. D. V.

PLAN OF THE EXPERIMENTS.

The original plan adopted for these experiments contemplated the following lines of work:

(1) The isolation of fresh cultures of human tuberculosis from sputum and from cases of generalized tuberculosis in adults and chil-

dren, obtaining whenever possible material from cases which indicated an involvement of the abdominal viscera.

(2) The inoculation of cattle and hogs intravenously and subcutaneously with the cultures or material so obtained.

(3) The feeding of human tuberculous material to calves.

(4) The isolation of fresh cultures of bovine tubercle bacilli and their use for comparison with the cultures from human beings mentioned above.

(5) The subcutaneous and intravenous inoculation of cattle and hogs with such bovine cultures or with bovine tuberculous material.

(6) The inoculation of cattle with bovine and human tubercle bacilli which had been under cultivation in the laboratory for some years and which possessed probably a comparatively low degree of virulence.

It was our plan to trace the histories of the subjects from whom the human tuberculous material was taken and to give complete autopsy records of these persons. The animals which succumbed to inoculation were to be carefully examined after death, and the lesions found were to be studied microscopically in order to determine if possible whether or not the disease produced was of a progressive character.

Before the experiments progressed very far it became evident that certain of the projected details which seemed quite desirable could not be fully carried out. The subjects from whom the tuberculous material was obtained belonged mostly to the pauper classes, and it was impossible to ascertain with any degree of certainty the sources of their food supply. In addition, the family histories were valueless almost without exception. In other cases from which sputum was obtained no autopsy was made when the subject finally died, owing usually to prejudice on the part of relatives. The records of most of the cases of human tuberculosis are therefore very unsatisfactory in so far as they concern the mode of infection.

But let it be remembered that the primary object of these experiments is to determine whether tuberculosis in cattle may be brought about by tubercle bacilli which have caused serious or fatal disease in man. The source from which the human beings were infected may be of great importance when it can be traced, but it is not necessary to a solution of the problem which we have undertaken.

METHOD OF OBTAINING THE CULTURES.

Before discussing the general features of the experiments it should be stated that all the cultures used were isolated from guinea pigs which had been inoculated with material from the various cases of human and bovine tuberculosis. As a rule, the cultures were obtained

from the spleens of guinea pigs and grown on the egg medium, which has been described elsewhere. In the comparative inoculations the cultures were approximately of the same age and the doses given as nearly uniform as possible.

SOURCES OF HUMAN TUBERCULOUS MATERIAL.

As previously stated, we were unable to secure full data relative to the previous histories and autopsy conditions of many of the cases of human tuberculosis which supplied material for our investigations. In some instances the hospital records, although quite voluminous, were deficient in details of especial interest in experiments of this character; hence only such portions of them as have a direct bearing upon the origin or nature of the tuberculosis with which the several individuals were afflicted will be inserted in this report.

We must express our sincere thanks to the physicians who kindly furnished us with material and records from the several hospitals in this city. The tissue obtained from the Government Hospital for the Insane was sent to us, together with the postmortem records, by Dr. I. W. Blackburn, the pathologist of that institution. For the material from the Children's Hospital we are indebted to Doctors Grasty and Mason of the house staff, and for the sputum obtained from patients in the Washington Asylum Hospital to Doctor Price, house physician in the asylum.

(1) *Culture F T, human.*—This culture was obtained on egg from the lung of a guinea pig which had been inoculated intraabdominally with sputum from a 45-year-old negro woman whose occupation was that of a domestic. She was admitted to the Washington Asylum Hospital February 16, 1902, after a diagnosis of pulmonary tuberculosis with chronic interstitial nephritis had been made. There was nothing unusual during the course of her illness. She died February 23, 1902. No autopsy could be obtained.

(2) *Culture F L, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated intraperitoneally with sputum from a painter 40 years old. He was admitted to the Washington Asylum Hospital on June 26, 1902, after a diagnosis of pulmonary tuberculosis had been made. This patient died on November 4, 1902. Consent to a postmortem examination could not be obtained.

(3) *Culture S E No. 3, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated subcutaneously with a small fragment from the lung of a man 50 years old. This man was admitted to the Government Hospital for the Insane on July 28, 1890, suffering from chronic dementia. Owing to the patient's condition, no information could be obtained relative to his

previous history. The illness which terminated in his death appeared to begin on September 3, 1901, when he had a chill followed by fever. From that date the temperature varied from 98° to 102° F. On May 15, 1902, the abdomen was distended and the patient vomited copiously. Death took place on May 16.

The autopsy revealed pleuritic adhesions of both lungs. In the left lung old tuberculous deposits were found; in the apex there were some small cavities; secondary tuberculous granulations were scattered throughout the remaining portion of the upper lobe and in patches throughout the lower lobe. In the right lung old tuberculous foci were found in the upper portion and tuberculous nodules throughout the remainder of the organ. The liver had undergone fatty degeneration; the intestines, large and small, were extensively ulcerated; the ulcerations were especially numerous in the small intestine. Many of the mesenteric glands were enormously enlarged, caseous, and some of them softened. A few tubercle bacilli were found in smear preparations from the granulations in the lung, but none could be demonstrated in the caseous material from the mesenteric glands.

(4) *Culture G D, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated with a small fragment of a peritoneal tubercle from a man 19 years old. The man was admitted to the Government Hospital for the Insane on February 11, 1902, suffering with acute mania associated with generalized tuberculosis. The tuberculosis apparently began about three months before admission to the hospital. The temperature ranged from 99° to 101.8° F. The sputum contained a very small number of tubercle bacilli. The patient gradually lost strength after admission and died on May 7, 1902.

The autopsy revealed the following lesions: The lungs were adherent to the thoracic wall, except at the lower part of the left pleural cavity, where there was evidence of an old tuberculous empyema. Many miliary tubercles were scattered throughout both lungs but very few cavities were found. The bronchial glands were enlarged and caseous. The omentum, intestine, and all abdominal viscera were so bound together by inflammatory adhesions that it was impossible to remove any of the organs. The surface of the peritoneum was covered with yellowish white tuberculous masses ranging in size from a pin's head to one-fourth of an inch in diameter. The liver contained numerous tuberculous areas, some of which had broken down and produced cavities. The spleen was full of large tubercles; the kidneys showed numerous medium-sized tubercles. The intestines were matted together by adhesions and their mucous surface presented numerous small ulcers. There was also a tuberculous inflammation of the meninges of the brain. From the character of the

disease it was impossible to determine accurately the mode of infection; it appeared probable, however, that the bronchial glands were the first of the internal organs to be involved, and it is not unlikely that the infection entered through the mouth or throat.

(5) *Culture No. 12124, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated with a small fragment of the lung of a woman about 27 years of age. The woman was admitted to the Government Hospital for the Insane in November, 1900. She was an Indian, and was suffering from a form of congenital imbecility. She had lived the greater portion of her life in the woods, subsisting upon berries, game, and food which was given to her. No detailed family history was obtainable. At the time of admission there was no suspicion of tuberculosis, but she began to fail shortly afterwards. She died on June 26, 1902.

The following synopsis of the postmortem lesions was kindly furnished us by Doctor Blackburn:

1. Tuberculous pleuritis, nodular, left side only. 2. Pulmonary tuberculosis with perforation. 3. Pneumothorax and pulmonary collapse. 4. Tuberculous ulceration of the intestines. 5. Tuberculous lymphadenitis, mesenteric glands. 6. Tuberculous salpingitis with adhesions. 7. Perforation and localized peritonitis due to ulceration and adhesions of bowel in pelvic cavity. 8. Fatty infiltration of liver. 9. Moderate degree of interstitial nephritis. 10. Slight chronic lepto-meningitis and atrophy of brain. 11. Dilatation of left side of heart and cardiac thrombosis.

Remarks: The brief synopsis given shows the extent of distribution of the tuberculous lesions. The pulmonary disease seems to be ordinary acute phthisis. The pleural disease was unusual in that it was nodular and accompanied by active inflammation and was limited to one pleural cavity, the left. The nodules bore a considerable degree of resemblance to the pearl disease of cattle—a condition I do not often find. The intestinal ulcers were large and completely encircled the bowel. The primary seat of infection was probably the lungs.

(6) *Culture C No. 1, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated with a small fragment of a mesenteric gland from a child 19 months old. This child was admitted to the Children's Hospital on November 20, 1901. No family history could be obtained. The general history of the patient is as follows: A male child, fed partly at the breast and partly on cow's milk; had never enjoyed good health. On examination after admission to the hospital he was found to be markedly rachitic, and had a dull, apathetic expression. He was affected with a loose cough and his respiration was rapid and shallow. Mucous râles could be heard throughout the chest and some consolidation at the apex of the left lung was detected. The gastric and intestinal digestion was poor, but a physical examination of the abdomen failed to reveal anything abnormal. The patient gradually lost in condition from the time of

his admission; appetite was and remained very poor, the pulse was rapid and weak, and he gradually passed into a moribund condition and died on December 22, 1901.

The autopsy record, which was kindly furnished us by Doctor Grasty, is as follows, the portions which have no direct bearing on tuberculosis being omitted:

Thorax: The diaphragm was adherent to the base of the right lung. There was a general adhesive pleurisy on this side with imperfect crepitation of the lung, which was mottled and grayish and studded with miliary tubercles which were especially numerous over the superior lobe and in the region of the apex. A cavity in the apex was about the size of a hazelnut. The left lung was consolidated at the apex. There was imperfect crepitation throughout the organ, and miliary tubercles from 1 to 5 mm. in size could be seen throughout the lung tissue. The lower lobe contained two large cavities filled with purulent material and threads of necrotic tissue. A microscopic examination of the contents of these cavities revealed the presence of many tubercle bacilli. The tracheobronchial glands were enlarged and caseous. Both pleuræ were studded with tubercles. The brain was congested and at its base some tubercles and a serous exudate were found. There were also tubercles in the cerebellum and fourth ventricle. In the abdominal cavity the liver was enlarged and mottled but showed no signs of tuberculosis. The spleen was enlarged and infiltrated with tubercles. The intestine was generally hyperemic. In the duodenum, the jejunum, and the ileum, at intervals of from 3 to 6 inches, were a number of ulcerations, some flat and broad, others deep, punched out, and undermined, all ulcers running transverse to the axis of the intestine. Scrapings from the ulcers revealed tubercle bacilli. In the caput coli there were two large ulcerated areas, one just above the ileocecal valve, 1¼ inches in length and one-half inch wide, and the other just at the ileocecal valve, 1 inch long and very irregular in outline. A number of tuberculous ulcers were found in the colon also. Many of the mesenteric glands were enlarged and caseous.

Guinea pigs were inoculated from the spleen and from the mesenteric glands, and all died of tuberculosis.

(7) *Culture D T, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated with a small fragment of the lung of a girl 5 years old. The girl was admitted to the Children's Hospital February 28, 1902. The family history was negative. The child was reported to have been ill for approximately three months. On admission to the hospital her temperature ranged from 101° to 107° F. The clinical symptoms warranted a diagnosis of tubercular meningitis associated with pulmonary tuberculosis. The child died on March 10, 1902.

The autopsy was briefly as follows:

Some exudate at the base of the brain; the heart was normal; in the right lung there were a few tubercles. Hemorrhagic areas and tubercles were also found in the upper and lower lobes of the left lung. The liver was softened in places and old adhesions were found on its superior surface. The spleen was soft and exhibited old adhesions. The mesenteric glands were normal, as were the intestines and

kidneys. There is nothing in the autopsy record to indicate infection by way of the digestive tract. Smear preparations from one of the lung tubercles showed a few tubercle bacilli.

(8) *Culture E T, human.*—This culture was obtained from the spleen of a guinea pig which was inoculated with a small fragment of a mesenteric gland from a girl 12 years old. The girl had been treated twice in the Children's Hospital for tubercular peritonitis and apparently cured. The first attack occurred during the winter of 1900 and the second in March, 1901. On July 6, 1901, she returned to the hospital suffering from a tuberculous arthritis of the elbow joint. In December, 1901, a complete excision of the joint was made and the child progressed well after the operation. On February 22, 1902, a cold abscess on the back of the neck was opened. On March 8 she began to complain of slight abdominal pain; the temperature rose gradually and the vomiting which occurred was followed rapidly by stupor which deepened into coma, and the child died on the morning of March 9. The temperature shortly before death was 108.8° F. There was nothing in the history of this child to indicate the mode of infection.

The autopsy report, which was furnished us by Doctor Mason, is as follows:

Pleuritic adhesions on both sides. The lungs were free from tuberculosis; the heart was small and flabby. The abdominal cavity contained considerable fluid mixed with blood, pus, and intestinal contents. The omentum was much thickened and contained a large number of small tubercles. The omentum and intestines were adherent to the parietal peritoneum. The spleen was large and filled with tubercles; the kidneys were large and soft, but not tuberculous. The liver was very friable and filled with tubercles. The intestines were bound to the peritoneum and the neighboring coils were firmly adherent to each other. There were numerous caseous mesenteric glands; numerous ulcers distributed throughout the ileum. The lower portion of this section of the small intestine was constricted by bands of adhesive tissue and an area of about 7 inches was greatly congested and almost gangrenous. Just above this congested area were two perforations through small ulcers.

Smear preparations made from the mesenteric glands did not show any tubercle bacilli, but the guinea pigs which were inoculated with the same material developed the disease.

(9) *Culture C No. 4, human.*—This culture was obtained from the spleen of a guinea pig which had been inoculated with a small fragment of a peritoneal tubercle from a boy 5 years old. This child was admitted to the Children's Hospital on April 4, 1902. The family history and previous history of the patient as determined at the hospital were as follows: The parents were both alive and healthy, and had lost no children. The only other child was in good health. There was a history of some tuberculosis in the mother's family. The infant had been reared on condensed milk and until

the time of his present illness was said to have been a healthy child. During the summer and fall of 1901 ascites developed and the child was confined to bed for two weeks, the effusion disappearing, but a hard mass remained in the region of the umbilicus. During October, 1901, the patient developed pertussis, and the cough persisted until the time of admission to the hospital. About two weeks before entering the hospital, during coughing, a rupture of the abdominal wall occurred and an intestinal fistula resulted. When admitted to the hospital the child was extremely emaciated, had a severe cough, fever at night, seemed constantly disposed to sleep, and had no appetite. The patient did not improve in the hospital, and died six days after admission.

The autopsy was briefly as follows:

There was a generalized tuberculosis of the thoracic and abdominal viscera involving the lungs, spleen, liver, intestines, and lymph glands. The peritoneum and mesentery contained many tubercles. The mesenteric glands were generally caseous and enlarged. In the lower portion of the ileum was a perforation which connected with a cavity (completely walled off from the peritoneal cavity) which communicated with an opening at the site of the umbilicus. The intestines were so firmly bound down by adhesive tissue that it was exceedingly difficult to trace their course. No ulcers were found. The peritoneal tubercles were examined microscopically, but no bacilli found. The guinea pigs which were inoculated developed tuberculosis. It seems probable that the infection in this case as well as in the preceding one had its origin in the abdominal cavity, but from the rather meager details of the autopsy which are obtainable it is impossible to speak definitely in regard to this matter. On account of the age of the child and its previous good health, the infection most probably took place at some time subsequent to the date when it was weaned from its bottle.

(10) *Cultures Nos. 49 to 60.*—These cultures were of human origin. They had been grown in the laboratory for a number of years on liquid media and still retained the characteristic virulence for guinea pigs.

(11) *Cultures A 101 to A 125.*—These cultures represent different generations of the attenuated culture which has been under cultivation in the Biochemic Division for about ten years. Culture A 125 is the one hundred and fiftieth generation on glycerinized bouillon. This culture was originally received from Doctor Trudeau, who states that it was obtained by himself in 1891 directly from a case of miliary tuberculosis in man. It was afterwards passed through a rabbit and then cultivated on various artificial media. While

entirely avirulent for guinea pigs, it has the property of producing in cultures the substance which causes the fever reaction in tuberculous animals, and has for a long time proved very satisfactory for the preparation of tuberculin.

(12) *New York culture, human.*—This culture was obtained December 21, 1901, from a tuberculous lung which was sent to us by Doctor Lartigau, of the College of Physicians and Surgeons in New York. Similar material was also secured from New York on January 6, February 10, and March 3, 1902.

(13) *Sputum, human.*—This material was used for the inoculation and drenching of cattle.

SOURCES OF BOVINE TUBERCULOUS MATERIAL.

(14) *Culture bovine III* (Smith).—This was given us several years ago by Dr. Theobald Smith and since then has been cultivated continuously on glycerinized bouillon.

(15) *Culture C No. 81, bovine.*—This culture was obtained from the spleen of a guinea pig which had been previously inoculated with a fragment of a mediastinal gland from cow No. 81. This animal—cow No. 81—was affected with tuberculosis of spontaneous origin.

Record of cow No. 81: About 5 years old; June 25, 1901, tested with tuberculin; reacted; was removed from the healthy animals and placed in a stable with a number of other cattle which had also reacted to tuberculin; August 26, 1901, had a moist, dry cough, respiration regular and not labored; January 2, 1902, was removed to another stable and confined continuously in a box stall adjoining stalls in which other tuberculous animals were kept. Killed March 13, 1902, and examined postmortem.

Autopsy: Right lung is a solid mass of tubercles, excepting a small area at the superior posterior portion of principal lobe. Left lung contains many tuberculous areas, but is not affected to so great an extent as the right one. The tuberculous masses, on section, are found to contain lime salts, and many are broken down. There are also a number of distinct cavities which are partially filled with a gelatinous material. These cavities communicate with the bronchi, which, as well as the trachea, contain a large amount of the above material. The mediastinal glands are enlarged and are converted into masses of tubercles separated from each other by thickened connective tissue. These tubercles, on section, are found to consist of a firm, cheesy material, which contains lime salts. Liver contains several characteristic tuberculous nodules. Spleen apparently normal.

Nearly all of the mesenteric glands contain one or more tuberculous foci.

(16) *Bovine tuberculosis tissue.*—Material obtained from various cases of spontaneous tuberculosis in cattle.

EXPERIMENTS UPON HOGS.

It will be remembered that Professor Koch announced that he had been unable to produce generalized tuberculosis in hogs by subcutaneous inoculations with pure cultures of human origin. In order to determine the correctness of his views we inoculated eight hogs—some with human tuberculous material and some with pure cultures of the human tubercle bacillus—and also one hog with a bovine culture, the latter animal serving as a comparison with those inoculated with human virus.

The accompanying table presents in concise form the inoculations made and the results obtained.

TABLE I.—*Inoculation of hogs subcutaneously with human and bovine tuberculosis.*

Material used.	Dose.	Hog No.	Date of inoculation.	Result of inoculation.
	c. c.			
Human culture E T	2.0	[a] 457	Oct. 13, 1902	Died Dec. 13, 1902.
Do	2.5	[b] 455	Jan. 24, 1903	Remained in fair condition.
Human culture C No. 4	2.0	[c] 460	Oct. 13, 1902	In dying condition when killed.
Do	2.0	[b] 459	Jan. 24, 1903	Remained in fair condition.
Bovine culture C No. 81	2.0	[a] 483	do	Died Mar. 9, 1903.
Human culture C No. 1	1.5	[d] 230	Apr. 19, 1902	Remained well.
Human intestine (tuberculous)	Small piece.	[e] 226	Apr. 12, 1902	Remained in fair condition.
Do	do	[e] 229	do	Remained fairly well.

The following footnotes show the condition of the hogs after death:

[a] Generalized tuberculosis.

[b] Killed June 2, 1903. Generalized tuberculosis.

[c] Killed Nov. 11, 1902. Generalized tuberculosis.

[d] Killed Sept. 9, 1902. No tuberculosis.

[e] Killed Sept. 9, 1902. Generalized tuberculosis.

DISCUSSION OF HOG EXPERIMENTS.

From the above table it will be seen that of three cultures of tuberculosis from children, one proved to be practically without virulence for hogs, while the other two induced a generalized tuberculosis which was quite as severe as the disease caused by the bovine bacillus in hog No. 483. The lesions brought about in the hogs by the more virulent human cultures and the bovine culture were of the same character.

All the hogs used for these inoculations were in a perfect state of health at the beginning of the experiments.

As a result of these experiments upon hogs, the conclusion is justified that—

1. Certain tubercle bacilli of human origin possess quite as great pathogenic power for hogs as tubercle bacilli of bovine origin.

2. The disease induced in hogs by human cultures C No. 4 and E T was distinctly progressive in character, death taking place in two of the animals in twenty-eight and sixty days, respectively.

EXPERIMENTS UPON CATTLE.

In all cases perfectly healthy animals were selected, and no cattle were included in the experiments that had not failed to respond to the tuberculin test. After inoculation each animal was kept in a clean, separate stall, where there was no opportunity for the contraction of disease from other animals. The cattle were inoculated subcutaneously, intraabdominally, or intravenously, and some were fed or drenched with tuberculous material. In some instances it was possible to inoculate or drench cattle with human tuberculous tissue and later to inoculate others with pure cultures derived from the same human tissue. By this method we hoped to determine whether the virulence of the organism in question was heightened or lowered during the process of its isolation in pure culture. The dose given the cattle varied somewhat, but was in the main fairly uniform and not excessive, as will be seen by the examination of the tables which follow.

INTRAVENOUS INOCULATIONS.

One calf was injected intravenously with each of the cultures, as shown in Table II, but, owing to the fact that the microscopic examination of the organs of calf No. 265, injected with human culture D T, revealed the presence of large numbers of a microorganism differing from the tubercle bacillus, we will not take this case into account in determining the percentage of positive results. An examination of the record of calf No. 287, injected subcutaneously with the same culture—DT—indicates that this culture possesses distinct though rather feeble pathogenic power for cattle. If the record of calf No. 287 be compared with that of calf No. 223, injected subcutaneously with bovine culture III, it will be seen that, assuming the resisting powers of the two calves to be equal, human culture D T is nearly if not quite as virulent for calves upon subcutaneous injection as bovine culture III, and this bovine culture, upon intravenous injection, produced an infection of the lungs and lymphatic glands. Reasoning in this fashion, we are inclined to believe that human culture D T was the chief cause of the lesions found in calf No. 265.

TABLE II.—*Intravenous inoculations of calves.*

Material used.	Dose.	Calf No.	Age of animal.	Date of inoculation.	Result of inoculation.
	c. c.				
Human culture F T	5	*a* 270	1 year	Sept. 16, 1902	Recovered.
Human culture F L	5	*b* 275	9 months	do	Killed Nov. 3, 1902.
Human culture S E No. 3	5	*c* 272	8 months	Sept. 15, 1902	Recovered.
Human culture G D	5	*d* 271	do	Sept. 16, 1902	In moribund condition Nov. 26, 1902; killed.
Human culture 12124	5	*e* 289	6 months	Oct. 14, 1902	Killed Feb. 12, 1903.
Human culture C No. 1	5	*f* 273	8 months	Sept. 15, 1902	Recovered.
Human culture E T	5½	*g* 264	5 months	Aug. 9, 1902	Died Aug. 29, 1902.
Human culture D T	5½	*h* 265	do	do	Died Sept. 8, 1902.
Human culture C No. 4	5	*i* 274	7 months	Sept. 15, 1902	Died Oct. 2, 1902.
Bovine culture III	20	*k* 260	5 months	July 19, 1902	Died Aug. 6, 1902.

The following footnotes show the condition of the calves after death:

[a] After recovery from inoculation with human virus received bovine culture subcutaneously. No lesions at autopsy.

[b] Lesions found at autopsy were apparently not progressive.

[c] After recovery received subcutaneous inoculation of bovine culture. At autopsy lesions found in lung, but not severe.

[d] Lesions of tuberculosis not sufficient to account for condition at time animal was killed.

[e] Necrotic areas in lungs. Tuberculous lesions not sufficient to account for poor condition when killed.

[f] After recovery received subcutaneous inoculation of bovine culture. When killed later, found tuberculous lesions; probably due to bovine culture.

[g] Postmortem showed a severe generalized tuberculosis.

[h] Lesions of generalized tuberculosis. The microscope disclosed a contaminating organism, and fatal result may have been partly due to that cause.

[i] The postmortem examination disclosed a generalized tuberculosis.

[k] Tuberculosis involving lungs and some lymph glands.

Eight calves were injected intravenously with as many different cultures of tubercle bacilli of human origin, 5 being obtained from adults and 3 from children. Of the 8 cultures, 2, or 25 per cent, produced a fatal generalized tuberculosis. The 2 that produced fatal disease in calves were both derived from children; therefore, 2 out of 3 of the cultures from children were quite as virulent for calves as the bovine tubercle bacillus.

SUBCUTANEOUS INOCULATIONS.

It was not thought necessary to inject calves subcutaneously with the cultures which gave little or no evidence of pathogenic properties when injected intravenously. Six of the most virulent human cultures were therefore selected for the subcutaneous injections. As indicated in Table III, 7 calves were injected subcutaneously with the 6 cultures, and 1 calf (No. 250) was injected with human tuberculous tissue obtained from the same source as one of the cultures (C No. 4). Three of the 6 cultures used were derived from adults and 3 from children. The results of these injections may be summarized as follows: One culture failed to produce any lesion, per-

sisting for as long a period as nine months; 2 produced a localized abscess at the point of injection; a fourth culture produced a local lesion and the disease extended to the neighboring lymph glands. The 2 remaining cultures brought about a generalized tuberculosis in the calves injected with them. Taking into account, then, the whole number of human cultures isolated, we find that 2 out of 9, or 22.2 per cent, produced a generalized tuberculosis after subcutaneous injection. A third culture, D T, must be considered as infectious for cattle, as the disease within two months from the time of injection extended from the point of inoculation to the adjacent prescapular gland, and through that or some other channel to the deeper gland just inside of the thorax. We can then revise the figures just given, since out of 9 human cultures isolated, 3, or 33⅓ per cent, produced tuberculosis in cattle after subcutaneous injection. These 3 virulent cultures were all obtained from children, so that out of 4 cultures derived from cases of generalized tuberculosis in children 3 were capable of bringing about infection in cattle.

It will be remembered that in the summary of the intravenous injections it was stated that 2 out of 3 of the cultures from children produced tuberculosis in calves, while after subcutaneous injection we state that 3 out of 4 produced infection. This discrepancy is due to the fact previously explained that a mixed infection appeared to have taken place in the animal injected intravenously with culture D T, and for this reason the intravenous injection with that culture was thrown out.

TABLE III.—*Subcutaneous inoculations of calves.*

Material used.	Dose.	Calf No.	Age of animal.	Date of inoculation.	Result of inoculation.
	c. c.				
Tuberculous human lung and intestine.	1 piece of each.	[a] 259	1 year	Apr. 12, 1902	Killed Oct. 1, 1902.
Human culture C No. 4.	5	[b] 283	6 months	Oct. 13, 1902	Killed Nov. 14, 1902, when in dying condition.
Human culture E T	5	[c] 288	do	do	Killed Dec. 19, 1902; in fair condition.
Do	5	[d] 285	13 months	Jan. 24, 1903	Killed Apr. 28, 1903; condition poor.
Human culture D T	5	[e] 287	6 months	Oct. 13, 1902	Killed Dec. 19, 1902; condition fair.
Human culture G D	6½	[f] 221	18 months	Sept. 23, 1902	Still living; condition excellent.

The following footnotes show the condition of the calves after death:

[a] Tuberculosis of superficial lymph glands, and of the pulmonary and diaphragmatic pleuræ.

[b] The autopsy disclosed a severe generalized tuberculosis.

[c] Autopsy revealed lesions of a generalized tuberculosis.

[d] Generalized tuberculosis. Not so extensive as in case of calf No. 288.

[e] Glands adjacent to point of inoculation were tuberculous.

[f] Animal tested with tuberculin June 30, 1903, and did not react.

TABLE III.—*Subcutaneous inoculations of calves*—Continued.

Material used.	Dose.	Calf No.	Age of animal.	Date of inoculation.	Result of inoculation.
	c. c.				
Human culture F T	5	[a] 290	6 months	Oct. 14, 1902	Killed July 23, 1903, after tuberculin reaction.
Human culture F L	5	[a] 291	do	do	Do.
Bovine culture III	10	[b] 223	2½ months	Nov. 2, 1901	Killed Oct. 2, 1902; condition excellent.
Tissue from monkey No. 1, inoculated with bovine III.	Small piece.	[c] 226	1 month	do	Killed Oct. 6, 1902; condition poor.
Bovine culture C No. 81.	5	[d] 284	13 months	Jan. 24, 1903	Killed Apr. 10, 1903; condition poor.

[a] No lesions except abscess at point of inoculation.
[b] Abscesses at point of inoculation. Shoulder glands on same side and mediastinal glands tuberculous. No other lesions.
[c] Tuberculosis of lungs, spleen, mediastinal, axillary and shoulder glands.
[d] Generalized tuberculosis.

MISCELLANEOUS ANIMAL EXPERIMENTS.

Under this heading a few records are brought together which do not properly belong with the experiments previously described. As will be seen from Table IV, a calf was inoculated intraabdominally with tuberculous human sputum, a heifer was fed with similar material, and a sheep was inoculated intravenously with a pure culture of human tubercle bacilli.

As a control on the above inoculations a steer was fed tuberculous tissue from a cow.

TABLE IV.—*Miscellaneous animal experiments.*

Animal.	Material used.	Method of administration.	Age of animal.	Date of exposure to infection.	When killed.
Calf No. 254 [a]	Tuberculous human sputum.	Intraabdominal (5 c. c.).	7 months	Mar. 7, 1902	Sept. 23, 1902
Heifer No. 237 [b]	Tuberculous human tissue and sputum.	By mouth	2½ years	Nov. 22, 1901	Oct. 28, 1902
Steer No. 242 [c]	Tuberculous bovine tissue	do	20 months	Jan. 10, 1902	Oct. 6, 1902
Sheep No. 41 [d]	Human tubercle culture 50	Intravenous (10 c. c.).	Old ewe	July 19, 1902	Jan. 6, 1903

The following footnotes show the condition of the animals after death:
[a] Tuberculosis of peritoneum, lungs, and pleuræ.
[b] No tuberculosis.
[c] A few small tuberculous foci in mediastinal and anterior thoracic glands. No other lesions.
[d] Generalized tuberculosis.

As will be seen from the foregoing table, the intraabdominal injection of sputum produced a tuberculosis of the peritoneum and of the lungs and pleuræ. Feeding the sputum produced no effect on the

experimental animal, and the bovine tuberculous tissue produced only very slight changes in some of the glands when administered in the same way.

CONCLUSIONS FROM CATTLE EXPERIMENTS.

So far as our experiments upon cattle are concerned, we must conclude that tubercle bacilli of varying degrees of virulence for cattle may be obtained from human sources—some quite as virulent as the tubercle bacilli known to be of bovine origin and others less so.

The results of our experiments also lead us to conclude that there is no essential difference between tubercle bacilli derived from bovine sources and those derived from man. In fact, we know of no character possessed by bovine tubercle bacilli which may not be possessed by tubercle bacilli of human origin. The two most virulent human tubercle cultures described can not be distinguished from the classical bovine type either with regard to their cultural characters or their pathogenic power for cattle and other animals.

Dr. Theobald Smith has been the chief advocate for a racial distinction between bovine and human tubercle bacilli, although he does not deny the infectiousness of bovine tubercle bacilli for man. On the contrary, he considers those cultures of human tubercle bacilli which correspond culturally and in respect to their pathogenic powers with the ordinary bovine tubercle bacillus as being originally of bovine origin.

While we believe firmly that tubercle bacilli of bovine origin may infect human beings, we can not accept the theory that tubercle bacilli derived from man are necessarily of bovine origin because they possess characters of the ordinary bovine bacillus. In other words, in regard to those cases of human tuberculosis from which bacilli virulent for cattle are obtained, it must be shown first of all that the individuals in question became infected through tuberculous meat or milk. The possibility that the infection has been derived from cattle always exists, but in our opinion the biological characters of the infecting organism are not sufficient to show that meat or milk was the source of the disease, and in like manner a tubercle bacillus of low virulence obtained from cattle should be considered to be of bovine origin unless there is some evidence of infection from other sources. The fact that certain tubercle bacilli derived from man resemble the majority of bovine bacilli is, to our mind, evidence of the unity of the two races.

EXPERIMENTS UPON MONKEYS.

In addition to the investigations made to determine the extent to which tubercle bacilli of human origin are infectious for cattle, the intimately related question whether tubercle bacilli of bovine origin

are infectious for man was approached as closely as possible by a series of experiments with monkeys.

It is a generally admitted zoological fact that man stands in closer relationship to the Quadrumana than to other animals. With this view accepted, we may reasonably assume that similar disease-producing microorganisms found in man and cattle, the identity of which has been questioned, are practically the same in their pathogenic significance if they produce identical affections in monkeys.

Of the monkeys used in our experiment one was a Cebus, two belonged to the genus Rhesus, and four were baboons. Two tubercle cultures were used, one—No. 50—of human origin, which had been under cultivation for a long time at the laboratory and was virulent for guinea pigs, and the other bovine culture III.

Four of the monkeys received injections of bovine tubercle culture; two received injections of human tubercle culture, and one was fed milk containing bovine tubercle bacilli. No cow could be found with a tuberculous udder which had become infected in the natural way at the time the feeding experiment was made, and so the milk was obtained from a cow into whose udder bovine culture III had been injected. The milk from the udder-injected cow showed the presence of tubercle bacilli on microscopic examination, and on injection into guinea pigs caused fatal generalized tuberculosis.

The monkeys were confined in large cages, each of which was supplied with perches and a partly closed sleeping compartment to which the animal could retire at will. The cages were placed in a one-room, properly heated, well-lighted and ventilated house, which was guarded during cold weather against sudden changes of temperature by a small vestibule with inner and outer doors. Both the cages and the house were specially constructed for this experiment and had not been used previously for any other purpose.

The results of the inoculations are shown in the accompanying table:

TABLE V.—*Monkey experiments*

Material used.	Method of administration.	Dose.	No. of monkey.	Date of inoculation.	Result of inoculation.
		c. c.			
Culture bovine III	Subcutaneous	1	1	Sept. 12, 1901	Killed Oct. 30, 1901. [a]
Do	do	½	2	do	Killed Nov. 22, 1901. [b]
Culture human No. 50	do	1	3	Nov. 7, 1901	Killed Dec. 30, 1901. [b]
Culture bovine III	do	1	4	do	Killed Dec. 23, 1901. [b]
Culture human No. 50	do	1	5	do	Died Dec. 21, 1901. [c]
Culture bovine III	do	1	6	do	Died Dec. 11, 1901. [c]
Tuberculous milk (culture bovine III).	By mouth	(d)	7	July 17, 1902	Died Mar. 26, 1903. [c]

[a] In dying condition when chloroformed. Generalized tuberculosis.
[b] In dying condition when chloroformed. Lesions of generalized tuberculosis.
[c] Lesions of generalized tuberculosis.
[d] Fed twice daily until Nov. 10, 1902.

It will be well for us to state that the tuberculous character of the lesions in the monkeys used in the experiments was confirmed in all cases by microscopic examination or by guinea-pig injection, or by both.

DISCUSSION OF MONKEY EXPERIMENTS.

The results obtained in the experiments with monkeys seem to justify the conclusion that no important difference exists between the two tubercle cultures used. One was a standard culture of human origin and the other a standard culture of bovine origin. The detailed records of the experiments give no other evidence against the identity of the two germs than that of a possible difference in virulence, and that a difference in virulence of tubercle bacilli from different sources exists, at times even when they are obtained from different organs of the same subject, is an old story.

Monkey No. 7 was kept under observation a long time, and gave no evidence of tuberculosis until a number of months had elapsed after she was fed milk actually containing tubercle bacilli, and it may be well, therefore, to say, in support of our conviction that the disease was due to the tubercle bacilli contained in the milk, that several other monkeys of the same species were kept under precisely similar general conditions, in other experiments, in adjoining cages in the same one-room house without contracting tuberculosis. This monkey indicates at one and the same time that tuberculosis contracted through ingestion progresses more slowly than tuberculosis induced by a subcutaneous injection; that a fairly generalized fatal tuberculosis can be produced by ingestion without specific lesions of the intestines; and, finally, that monkeys, notwithstanding their distance from cattle in the animal scale, are highly susceptible to the pathogenic properties of tubercle bacilli of bovine origin which gain entrance to their bodies with the food they eat. The question regarding the susceptibility of man to tubercle bacilli of bovine origin can not be more closely approached in an experimental way, and this experiment alone, supported by the large existing mass of circumstantial evidence of the infectiousness of tubercle bacilli of bovine origin for man, seems sufficient to warn every reasonable mind against the use of milk from tuberculous cows, and to point out with the greatest emphasis that it is desirable to take measures which will eventually eliminate all tuberculous cows from our dairy herds.

While it is not disputed that a majority of the persons who become infected with tuberculosis contract the disease from other human beings, it is maintained that cattle also constitute a very important source of infection. The importance of the latter source can not easily be overestimated in the light of the very considerable evidence which is accumulating in support of the view that human and bovine tuber-

culosis are not essentially dissimilar. It is true that a difference does exist between certain tubercle bacilli of human origin and those of bovine origin, yet it is not a specific difference or even a difference which permits the grouping of the germs as distinct varieties of the same species, but a difference practically confined to pathogenic virulence, and which forces us to regard the tubercle bacilli of bovine origin merely as more virulent than those of human origin.

HUNTER-HORSE PRODUCTION IN IRELAND.

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INTRODUCTION.

Notwithstanding the marvelous advances which have been made from time to time through the aid of science and genius in perfecting and adapting steam and electrical appliances to the purposes of locomotion, the horse still occupies a place of the utmost importance. The hunter or riding horse is always in demand, whether in time of war or in peace. The success of a nation is largely determined by her military strength, and recent events have shown that success in war may depend as much on military remounts as on any other factor.

At the request of the Secretary of Agriculture the writer made a careful study of the methods employed by Irish farmers in producing the type of hunter horse for which Ireland is so justly noted in all parts of the civilized world. This was done in the hope of securing and systematizing information pertaining to the breeding of these horses which would be of assistance to the American farmer. Although some attention has already been given to this industry in the United States, the work could be carried on, in the opinion of many people, on a much more extensive scale, both to the financial advantage of farmers and to the strength and prestige of the Army. Few countries possess better natural advantages than our own, either in soil or climatic conditions, for breeding this class of horses. The Eastern and Western States have natural advantages which are especially favorable. Their conditions are very similar to those in the most highly favored breeding districts of Ireland. Many authorities believe that the factors which have given the Irish hunter horse his prestige are the environments within which he is reared—namely, abundance of outdoor air and exercise and the limestone pastures on which he grazes the greater portion of the year.

The question at once suggests itself, Is the demand for this class of horses sufficient to justify American farmers in engaging in its production? This depends almost solely on the quality of the animal produced. If good care and judgment are used in the selection of

suitable sires and the proper mating of the mares, so that animals of excellent quality are bred, the progeny, if well trained, would meet with ready sale at highly remunerative prices. On the contrary, if haphazard methods of breeding are practiced, the results will certainly be most unsatisfactory and disappointing. There always has been a good demand for high-class riding horses at home, and this demand is on the increase. However, the supply is obtained by picking up promising animals over the country and not by systematic breeding. In addition to the home demand there would gradually develop a profitable export trade to Great Britain and continental Europe. Recent investigations by the writer in all of those countries have shown conclusively that there is a strong and rapidly increasing demand for this type of horses at highly remunerative prices. In England they are wanted by the higher classes of people for hunting and riding, while several of the Continental countries are annually importing large numbers. Aside from this demand, all of these countries annually import thousands of such horses, at prices which would be profitable to our eastern and western farmers, to supply the needs of their army remount systems. Although Ireland is the most highly favored breeding ground for such horses at present, there is reason to believe that the United States could, at an early date, secure her share of the trade. While it may not be very generally known, it is true, nevertheless, that American-bred horses are annually imported into Ireland, and after several months training on Irish soil are sold at handsome profits to England and other countries—not always as American-bred, but very often as Irish hunter horses. Some of these American-bred horses have won many of the best prizes for hunter horses in the leading English shows, including the Hunter horse show. The writer is also informed that only a few years ago an exhibitor from the west of Ireland exhibited, under an Irish name and breeding, at the Royal Dublin Society's Horse Show—the greatest hunter-horse show in the world—an American-bred horse which not only won the first premium in his class, but also the champion cup for the best hunter horse in the entire show. At this show there were about 1,000 entries, which included the cream of the country. What better evidence could be desired of our possibilities in the production of this class of horse?

Much of the failure in this line of horse breeding in Ireland is due to a factor which is not nearly so prevalent in the United States, namely, small tenant farmers, who are almost poverty stricken on account of high rents and other conditions. No person who has not visited these districts can form a fair conception of the large percentage which exists of this class of people and their influence on any industry. These poor people are more or less engaged in the

production of horses, and to them the only commendable feature of a sire is the smallness of the fee for which his service can be secured. Where such methods or lack of methods in breeding are continually practiced there will always be a great many useless animals, which must be termed misfits so far as hunter horses are concerned. While the production of high-class hunter horses, like that of any other high-class horse, is by no means a certainty, nevertheless, when the breeding is conducted in a systematic manner the results will certainly be more favorable than the casual observer of Irish horse breeding might consider them to be from general impressions obtained by a hurried visit in the country. This conclusion is amply justified by the results obtained by men who have followed system and used judgment in the work.

It is a lamentable fact that the Irish people did not many years ago appreciate as they do to-day the need of some form of registry association, where animals conforming to the desired type might have been entered as foundation stock to afford breeders and farmers an opportunity to breed and develop horses in a consistent and systematic manner. While they have a truly recognized type of what a hunter horse ought to be, in the majority of instances this horse could not resemble either parent and be true of his type. He is often the result of chance—the progeny of a large sire and a small mare, and *vice versa*. It is impossible to secure uniformity of type when such methods are practiced. No people appreciate this more fully than the better class of Irish breeders and farmers. For some time methods have been under consideration for the purpose of removing this difficulty. The excellent work now being undertaken by the department of agriculture in the registration of suitable sires and the nomination of desirable mares, so that they may be bred free of charge, or almost so, to sires of the desired type and conformation, will have an influence which will be far-reaching and will in time be the basis of a new and systematic era in horse production in Ireland.

IMPORTANCE OF THE HORSE INDUSTRY OF IRELAND.

Ireland, in a large degree, is dependent upon her agricultural resources. This being true, we would naturally expect her people to engage in those branches of work which are most likely to defy foreign competition in the markets of the world. As a result, we find that live-stock husbandry, in some of its numerous lines, occupies the principal place in the farming operations. While the production of meat animals, such as beef cattle, sheep, and bacon hogs, and dairy farming have always been prominent features in all sections, yet the most important branch of the live-stock industry of Ireland, when compared with that of other countries, is the production of horses.

Not that horse production is any more profitable to the farmers of Ireland than the other classes of live stock mentioned, but that in some way or other the merits of the Irish horse have for generations stood out preeminently in certain lines above those of similar classes of horses produced in almost any other country. This is especially true of the Irish hunter horse. Ireland might quite properly be described as a grass country. More than 80 per cent of her entire area is under grass or meadow, and more than 60 per cent of her area is devoted to permanent grass land. With such conditions prevailing, we can at once appreciate the importance of the live-stock industry. Then, too, when we consider that the rainfall is heavy and very uniformly distributed throughout the year, we can appreciate more fully the importance of the grass crop. In no other country have I seen anything which approaches Ireland in grass production. My visit there was during the latter part of August and September, the season of the year when we would expect to find a shortage, but such was not the case. Another factor which, in the estimation of many people, renders the country especially well adapted to the production of horses is that throughout the greater part there exists a limestone soil. This soil is thought to produce a grass containing a high percentage of those mineral elements which are instrumental in producing a hard, flinty bone which is so much desired in the horse. This is a natural advantage which aids materially in the production of a first-class horse. Countries which are not so favored from a natural standpoint will find this a handicap in competing with the Irish farmer in the production of breeding animals.

The climate, too, is decidedly favorable for the production of any class of animals. It is very uniform and temperate throughout the year. During the summer, while at certain times the weather is warm, it is at no time unbearable or of such intensity as seriously to interfere with the comfort of animals. Mild weather also prevails during the winter season; thus animals of all classes graze more or less during each of the twelve months of the year. This is a wonderful advantage in that it lessens the cost of keep, and at the same time allows the young animals plenty of freedom, pure air, and nature's ration, all of which are so beneficial in the proper development of any class of animals. Blessed with so many natural advantages, the Irish people as a class make full use of them; that is, they are not soil tillers, but believe in letting nature not only produce the feed for the animals, but also cure it and furnish the feeding grounds.

In the majority of instances on Irish farms, the easiest way is the best method of accomplishing the desired end. For centuries the Irish people have been fond admirers of sport. This accounts in a large measure for the Irishman's preference for the horse over any

other animal. It is also responsible for the existence and development of a racing horse. Perhaps under more favorable natural surface conditions of the land they might have devoted their attention to the breeding and development of a trotting horse, but for a rather rough and broken country the saddle horse was better adapted and given the preference.

While horse breeding is carried on in all parts of the country, certain districts, on account of natural advantages or the inclinations of the people, are more largely devoted to this branch of work. There is also more or less diversity of type in the animals produced. Those who are in a position best to know the prevailing conditions and those which formerly existed claim that it was largely during the last quarter of the nineteenth centruy that this diversity of blood, which has resulted in a mixture of types, was introduced into the country; that previous to that time the horse-breeding industry was more largely confined to the production of one or two types, which answered admirably the needs of the home people and commanded the attention of foreign buyers.

Eminent authorities on Irish horse breeding claim that for centuries there existed two types of horses which possessed wonderful merit and were noted throughout Ireland, Great Britain, and continental Europe for their endurance and usefulness, namely, the "Irish horse" and the "Hunter horse," the latter being the progeny of the Irish mare and the Thoroughbred sire. One authority describes the "Old Irish mare" as "small, clean-legged, and very hardy." In discussing this class of horses, he says:

> This breed originated in the numerous Spanish stallions brought to Ireland in the fifteenth century. There was a regular trade between the south and west of Ireland and Spain for many centuries; Ireland exporting wool, hides, and butter, and receiving in return wine, cloth, horses, and specie. This class of Spanish horses introduced was the Andalusian Barb. To this element may be attributed the extraordinary endurance of the Irish hunter of the present time. The outward and apparent influence of Spanish blood can at present be recognized only in the Connemara pony.[a]

This quotation was taken from the report of a special commission appointed by the Government, in 1896, to inquire into the horse-breeding industry of Ireland. Mention is made of this "Old Irish horse" because it is claimed to be the foundation stock, on the dam's side, from which the famous Irish hunter horse originated. Some farmers, even at the present time, advance claims of having mares descended from this famous stock. It is more than probable that the majority of these modern Irish mares are the result of the mating of a hardy dam with some high-grade sire, being the result of accidental rather than careful breeding.

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[a] For description of the Connemara pony, see page 201.

In considering the present status of the Irish horse industry the country may be divided into five districts, namely, the northern, western (including the "congested districts"), southern, eastern, and central districts. The northern district is devoted largely to the breeding of draft horses, harness horses, and the fattening of horses purchased in all parts of the country for the market. In the western part, in the "congested districts," the attention of the people has been largely confined, on account of the barrenness of the country, to the breeding of ponies, but in recent years considerable Hackney blood has been introduced for crossing.

The southern, eastern, and central portions of the country are the principal breeding ground of the hunter and racing horse. In all of these districts there is more or less of a tendency to breed other than the types mentioned, but it is of a very secondary nature. It is impossible to secure any reliable statistics relating to the numbers of each type of horse in the country. Instead of classifying them by breeds or types, a procedure which would be well-nigh impossible, they are classified according to age, so far as the mature or immature animals are concerned. But in the agricultural statistics of Ireland is to be found, for the year 1903, a carefully revised list of the stallions owned and used for breeding purposes. This gives a useful and instructive division of these sires, so far as the breed and district location of each are concerned. According to these statistics there were, in the year 1903, in all, 2,460 stallions used for breeding purposes. Of this number 662 were Thoroughbreds, 561 half-breeds,[a] 491 agricultural sires,[b] 371 Clydesdales, 116 Hackneys, 113 Shires, and 146 of all other breeds. A study of these figures will show that practically 50 per cent of all the sires used belong to the first two classes, which are used for the purpose of producing race and hunter horses. About one-fifth, or 20 per cent, of the entire number belong to the so-called "agricultural" class of horse. These horses are very popular with the farmers, as they possess sufficient weight to till the soil, and the mares, when crossed with good Thoroughbred sires, oftentimes in the first, second, and third crosses, produce high-class hunters. In fact, if it were not for this class of horses, the Irish farmers would long ago have been obliged either to give up hunter-horse production or to follow the work with more system.

Of the draft breeds the Clydesdale is the most popular. During the last two decades a considerable number of Hackney stallions have

[a] By the term "half-breds," is meant all so-called "Thoroughbreds" not entered in Weatherby's Studbook, hunter sires, and animals possessing one or more Thoroughbred crosses, but not eligible for registration.

[b] By the term "agricultural sires" is meant those horses of mixed breeding which possess sufficient size to warrant their use in the production of the so-called "general purpose" farm horse.

been imported from England. This has been done for the purpose of breeding a high-class harness horse in certain parts of the country. The scheme, while fostered by the Government, has met and is still having to contend with vigorous opposition from those interested in the production of hunter and saddle horses. They claim that there is no need of introducing any foreign blood for the purpose of producing a harness horse, as from the use of Thoroughbred and hunter sires there will always be a large number of animals well suited to harness purposes; that the Hackney blood will be distributed over the various districts and in time will seriously injure the hunter-horse breeding industry, as in their opinion the Hackney, while nice to look at, does not possess sufficient endurance, a feature for which the Irish horse is noted. This is a bitter question among horsemen at present, but that harness horses of high quality can oftentimes be produced from Thoroughbred and hunter sires the writer is convinced. While in Ireland he inspected many harness horses bred in this way. Perhaps these horses do not, as a rule, possess as high action as animals sired by coach horses, but there is one thing very evident, and that is that they have a long, true stride, which renders it no task for them to cover distances in a manner which is seldom found in the high-acting horse.

The main object in Irish horse breeding, to all appearances, is to produce the type or types of horses which will attract the foreign buyer. While the home trade is important, it is of a very secondary nature when compared with the export demands. This latter trade has been growing steadily for more than a century, till at the present time it means an income of many millions of dollars annually to the country. The principal business is in hunter and saddle horses. In addition to this trade, there is also a demand for draft, harness, and remount horses. This latter class and a considerable number of the harness type are animals from Thoroughbred or hunter sires, which, on account of some deficiency, are not suitable as hunter horses.

THE HUNTER HORSE.

Before discussing the various methods practiced by Irish farmers in producing hunter horses, it is deemed advisable to describe, as nearly as possible, what constitutes a high-class hunter horse.

This type of horse derived its name from the purpose for which it was formerly almost solely used, namely, hunting. For centuries in Great Britain and Ireland it has been the prevailing custom among the nobility and the more wealthy classes of the people to organize "hunts" at certain seasons of the year. These hunts vary somewhat in their nature, but generally have for their object the capture of a fox or stag. Sometimes, however, " drag hunting " is resorted to, but as

this feature has no other prize than the pleasure of a ride across a path of country, laid out for the purpose, it is seldom indulged in, except when other hunts are impossible. A noted authority in discussing this latter method of hunting in Baily's Hunting Directory for 1899–1900 says:

> Drag hunting is, of course, only excusable in a country where there is no animal suitable to hunt, or where the country is so cut up by wire, market gardens, railroads, canals, and other obstacles that any but a selected line is out of the question. To those who live in such a country, the drag affords a legitimate excuse for a gallop over fences. Those who hunt to ride rather than ride to hunt find that it has many very great advantages.

The above quotation sums up the whole question of hunting as practiced in the countries mentioned. The main object of the hunt is to secure as much riding as possible, anywhere and everywhere over the country, and the most successful hunts are those which require the greatest amount of riding and time before the victim of the hunt is captured. These hunts are most highly appreciated when the fox or stag selects the route having the greatest number of difficult fences, hedges, ditches, mounds, and other obstacles. This being true, we can appreciate, in a measure at least, the importance of the rider's, especially should he weigh 210 pounds, having a horse capable of enduring feats and trials unknown in any other kind of work to which horses are subjected. While there is always much pleasure to be derived from a ride across such paths, yet the true sportsman is not contented to be bringing up the rear of such a procession. The desire of all those who participate in such sport is to have horses which will carry them always to the very front. Thus the demand for a riding horse of such conformation and breeding as to render him able to carry a heavy-weight rider at a very high rate of speed over all kinds of soil, fences, ditches, and such other obstacles as might present themselves in the course has resulted in the production of the type of horse commonly designated as the "heavy-weight," or "weight-carrying," hunter.

That such a type of horse is hard to produce with any degree of certainty is not at all difficult to understand. He is a combination animal. Speed alone does not make a hunter horse; neither does the ability to carry heavy weights qualify a horse for this class. He must be able to carry a heavy weight at a high rate of speed for a long time over any kind of ground or obstacle. A horse lacking in any one of these requisites can not be considered a first-class heavy-weight hunter. Breeders who have failed to keep all the above-mentioned points in mind have never met with any degree of success in producing this class of horses. Some people fail to appreciate the fact that there is any difference whatever between a high-class saddle horse and a hunter horse. They claim that the saddle horse, provid-

ing he is a good jumper, is suitable for hunting purposes. This is an erroneous idea. While a good hunter may also be a good saddle, or riding, horse—in fact, if well broken, he is always such—the opposite is seldom true. This is due to the fact that but very few saddle, or riding, horses possess bone and constitution sufficient to endure the hardships to which the hunter is subjected. Thus in the ordinary methods of breeding, as practiced, it is the exception to find a horse with sufficient substance to make a good hunter. The opposite is usually true in the production of hunter horses, as the majority of those produced are much better suited to fill the demands of the saddle or riding horse than those of the hunter type.

While horses have been bred more or less in many countries to meet this demand, Ireland has been more successful in this direction than any other country. The Irish hunter horse has the reputation of being able to withstand the severity of the work better than those bred in any other land. Thus a description of the Irish hunter horse, as seen on his native soil, should be an aid to those interested in the production of the hunter horse. For centuries these animals have been bred in Ireland; hence the more intelligent class of farmers and breeders are well versed as to what constitutes the highest type of weight-carrying hunter. In obtaining a detailed description of the hunter horse, in addition to a close study of a large number of the best specimens, the writer consulted freely with the best breeders and judges, so that a careful and accurate idea of the essential points might be obtained.

At all the leading horse shows there are at least three distinct types of hunters recognized, namely, "heavy," "medium," and "light-weight" animals. These terms of weight have reference to the weight of the rider which the animal in question is capable of carrying, not to the number of pounds which the animal itself will weigh. The latter point is no criterion of the strength of an animal, as that is determined by certain points in the conformation. The term "heavy-weight hunter" is usually applied to an animal whose conformation is such as to render it able to carry a rider of at least 210 pounds' weight over all kinds of ground and obstacles at a good fast gallop for several hours; "medium-weight hunters" are required to carry from 182 up to 210 pounds' weight; while "light-weight hunters" must be able to carry at least 168 pounds over the courses.[a] While the differences in the weights may not appear to be very great, nevertheless they are. When an animal is forced to do its utmost

[a] The classes for American hunters are considerably lighter. At the national horse show at Madison Square Garden, New York, heavy-weight hunters are those up to carrying 190 pounds; medium weights, those up to carrying 165 to 190 pounds, and light weights, those up to carrying 165 pounds.

for a considerable period of time, every additional pound makes a marked difference. The medium-weight hunter might, under the most favorable conditions, carry a heavier weight, but should it be forced to meet unfavorable conditions, the life of both the horse and the rider would be endangered. For this reason, hunting men always prefer a horse capable of doing more than will be expected of him in the majority of chases. As a result, the demand for heavy-weight hunters always exceeds the supply, and it is the last 10 or 20 pounds which a horse is capable of carrying which enhances his value materially on the market. In discussing the advantage of weight in selling the draft horse, it has often been asserted that each additional pound of flesh which a horse carries, after the 1,600-pound mark is reached, is worth 25 cents up to 1,800 pounds, and each additional pound thereafter is worth 50 cents, providing that the other essential points of the horse are present. If we were to make a somewhat similar assertion concerning the influence which increased ability to carry weight had on the market value of a hunter horse, it would be approximately as follows: Taking 168 pounds as our limit, each additional 14 pounds up to 196 would readily command $100, while every additional 14 pounds after the 196-pound mark is reached would easily enhance the value of the horse by at least $200; providing, of course, that all the other essential points which go to constitute a high-class hunter were also present.

Thus we can readily appreciate the importance of aiming to produce the very highest type of hunter horse. In submitting the following points to be observed in the production of a high-class heavy-weight hunter horse, the writer includes a full description of all the parts of a horse, many of which are not unlike those present in a high-class horse of any other type:

Head.—The ears should be fine, not too long, approaching each other at the tips when thrown forward, and not too wide set at the base. Ears which are wide apart at the base are never carried well and disfigure the head very much. The forehead should be flat and wide between the eyes, indicating intelligence and a good disposition—two very great requisites in the hunter horse.

The eyes should be wide apart, prominent and bold in expression, indicating vigor and stamina. The nasal bones should be straight in front, slightly dished on the sides, giving a clean-cut appearance.

An important point to be observed is the nostrils, which should be firm, large, and flexible, so as to insure plenty of lung capacity. The lips should be held up firmly; mouth of medium size; muzzle neat, and branches of the lower jaw well spread apart at their angles so as to allow sufficient freedom for the windpipe.

Neck.—Clean-cut, medium length, very muscular, head well attached in a graceful angular manner; the jugular gutter must be well developed and the neck must blend smoothly into the shoulders and back.

Withers.—This part should be well developed, of medium height, and blend nicely with the shoulders and back.

Shoulders.—Long and sloping, so as to allow free and easy action. The sides of the blades must be well covered with muscle.

Chest or girth.—This is one of the most vital points to be considered in this class of horses. It is here that he gets his staying power, which is so essential in a long trial. Depth of chest accompanied by fair width can not be too strongly emphasized. Many a horse that would otherwise be classed as a good hunter is rejected on account of a slight slackness in his chest, due to lack of depth and width. Good authorities claim that the girth measure of a horse in hunting condition should be better than 6 feet.

Arms.—The arms should be thrown well forward, so as to give sloping shoulders which blend snugly with the back.

Forelegs.—We have now come to one of the most vital points in the make-up of the hunter horse. The forelegs are usually the first part of the mechanism to show weakness as the result of continued hard work. That portion between the elbow and the knee, called the forearm, should be fairly long, well developed, and very strong; well covered with hard, well-developed muscles, with grooves of demarcation between, so that each individual muscle stands out prominently. The knees should be clean cut, large from side to side and from the front portion backward, and strong in all directions; the bone forming the back part should be somewhat prominent. The cannon should be short, broad in front, flat viewed from the side, and clean in all its parts; the tendons should stand out plainly and be of a hard, cordlike appearance. The lines of demarcation between the tendon and ligament and bone should be well defined. These parts must be well supported below the knee, having from 8¼ to 9 inches of bone, so as to avoid the slightest tendency toward weakness. The fetlock must be strong and well supported in all directions. The conformation of the pasterns is another important point; they must be of medium length and fairly sloping, so as to prevent any inclination toward a stubby, stilted gait, which is so hard on both the horse and the rider; but strength of pastern is indispensable and must not be sacrificed to slope. The feet of a good hunter are rather smaller in proportion than in some other types of horses, but they should be round, strong, and fairly deep in the wall. The sole should be concave, frog well developed; heels full, wide, and not too deep; toes in a straight line, turning neither in nor out while standing, as the feet should move in a straight line.

Body.—Viewing the hunter horse from the side one will at once be impressed with his depth of rib, shortness of topline, and length of underline. The back should be short, strong, and straight. Any inclination toward hollowness, or swaying of the back, is a most serious objection. The loin should be broad and well padded with firm muscles. The flank must be well let down, as nearly as possible in a line with the lower part of the body. A light flank is considered as indicative of poor staying powers.

Hind quarters.—The croup should be well muscled and carried out straight to the tail, which should be full-haired. An examination of a number of the best hunters at the recent horse show of the Royal Dublin Society revealed a slight inclination toward drooping from the hip points to the tail head, but it is very probable that these champion animals would have been deemed more nearly perfect had their croups been more nearly straight instead of having the slight tendency to droop. The thighs, quarters, and lower thighs, or gaskins, should be heavily muscled. Size and strength of the hocks are all-important, seeing that they are fulcrums upon which the whole power of the hind legs, and often the entire weight of horse and rider, depend. Too much stress can not be laid on the size and true formation of these important joints, for no matter how

well a horse may be formed otherwise, a pair of weak hocks will spoil the whole structure and have a tendency to lead to the development of disease. The hocks should be deep and strong in all directions, having all points well developed, but not rough. They must be free from malformations or puffiness; the joint should be well developed, straight on its back surface, and the whole joint clean, hard, and of an angular appearance. The cannons should be short and wider and flatter than in front; tendons well marked and the individual ones standing out conspicuously. There must not be any inclination toward a pinched appearance below the hock joint in front, and the cannon should gradually taper in width from before backward and from the hock to the fetlock joint. The fetlock joint should be large, clean-cut, and strong; while the pasterns should be of medium length, sloping, and strong.

The hind feet are smaller and not so round as the front feet, but the sole should be more concave; frog well developed; heel good width and not too deep. While dark color is preferable in the case either of fore or hind feet, white feet of good quality are not considered as being a very serious objection in an otherwise good horse.

Temperament.—Temperament is an important point in this particular class of horses. Viciousness or extreme nervousness can not be tolerated, as they not only endanger the life of the rider, but also that of other horses and riders in a hunt. A mild but energetic temperament is desired, and any deviation from such is objectionable. The skin and hair are points which add materially to the value of animals possessing good conformation. A soft, mellow, and loose skin is desirable; while the hair should be fine, silky, and straight; this applies also to the mane and tail when compared with other breeds.

Action.—The action should be prompt, free, and elastic; not too high knee and hock action, but going rather close to the ground, especially in the canter and gallop. Paddling, or rolling, of the front feet is a most serious objection, being not only ungainly to the eye, but very wasteful of energy. The hocks must be carried well together when moving, but not close enough below to cause interfering.

Color.—While this is largely a matter of preference, yet certain colors are very objectionable. This is especially true of all light colors, with the exception of grays. Light colors are called "soft colors," indicating that the animal possessing such lacks endurance. The most popular colors are dark brown, dark bays, and dark chestnuts. A gray horse possessing the requisites of conformation, while not so desirable as one of the colors mentioned, is very much preferred to light bays, light brown, or other light colors. The color of the legs is very important. Bay, red, or mealy colored legs are very sharply discriminated against, and although white legs are not objectionable, especially in chestnuts, whole colors are always given the preference.

Weight.—A peculiar and interesting feature of the work of all judges of hunters is that the weight of the animal is never considered; that is, in the discrimination between the different classes of hunter horses, the question of weight of an animal, a point so often considered in American horse judging, has no influence. The suitability or qualifications of an animal for some particular class are based on other points, such as the heart girth, strength of back, strength of hocks and knees, and the size of forearm, gaskin, cannons, and the amount of muscle present. These points, in the opinion of hunter judges, are much more reliable than pounds of avoirdupois, which are so variable, depending in a large measure on the amount of fat, not muscle, which a horse carries. Such measurements as 8½ or 9 inches of bone in the fore cannons and a heart girth exceeding 6 feet are points worth keeping in mind when

examining this class of horses. It is so easy to make a difference of 100 or 200 pounds in the weight of an animal by excessive feeding.

Height.—The height of the hunter horse is variable. It must be in proportion to his width and especially his depth of body. From the side view a good hunter should not appear in the least "leggy." The majority of the best weight-carrying hunters range from 15 to 15.3 hands high. It takes a massively-built horse to raise the standard to the height of 16 hands and be justly termed a well-proportioned animal. In fact, some of the most desirable hunters are under 15 hands in height; still, the preference is for the horse so built in all of his parts that he will look right at 15.2 hands in height. Such an animal generally possesses a more graceful and stylish appearance. The above description applies to the heavy-weight hunter horse only. With some modification, however, it will apply fairly well to the medium-weight and light-weight hunters also. The two latter classes differ only from the former class, in that they have not sufficient size and endurance to carry heavy-weight riders. The most noticeable points of difference are to be observed in the depth of body and heart girth, muscling of back and loin, and strength of fore and hind legs. The knees and hocks will not be so large, the cannons smaller, and the forearms and gaskins smaller and not so well muscled. It is simply a difference in those points which indicates ability to carry weight and endure severe work. The lighter weights, as a general rule, possess more quality and show better breeding, so far as the blood of the Thoroughbred is concerned. In fact, they are usually smaller because they are more highly bred, having one, two, or three more crosses of the Thoroughbred sire in them. Aside from this the same general type holds good in all classes.

NOTE.—The photographs used in this connection are all of horses which won in their respective classes in 1903 and 1904 at the Royal Dublin Society Horse Show, which is held annually in the city of Dublin, and is noted the world over as being the most important show of hunter horses held in any country. The entries numbered more than 1,000 in both 1903 and 1904, and, coming from all parts of the country, the first-prize winners and champions are justly entitled to be classed as the very highest types of hunter horses to be found in Ireland.

METHODS PRACTICED IN PRODUCING HUNTER HORSES.

Notwithstanding the fact that the Irish farmers have been engaged, more or less, in the production of hunter horses for centuries, up to the present time there has been little or no united effort on the part of these people to adopt uniformity in their methods of breeding. These have been largely guesswork with the majority engaged in the business. When one method failed some other was resorted to for a short time, and then a return to the old way again. This is largely due to the fact that in the earlier days of hunter-horse production the Thoroughbred sire was almost exclusively used on the mares of the country. In many instances excellent results followed this method, and thus many people were led to believe that it was the one way to produce such a horse. For this purpose large numbers of Thoroughbred sires were imported into Ireland. The real cause of the trouble which has so often led to disappointment of

breeders seems to be rooted in the fact that the Thoroughbred horse of recent years, as a class, is very different from the Thoroughbred of a century ago. The breeders of this class of horses during the last hundred years have devoted their attention almost solely to increased speed, which was too often obtained at the sacrifice of other essential points, such as size and substance. Thus the majority of Thoroughbred sires of the present day are lacking in some of the most essential points which constitute a high-class hunter horse. Most fortunate for the hunter-horse business, there is still a small percentage of useful Thoroughbred sires which, when mated with the proper type of mare, will produce the very highest type of hunter horse. Then, too, there is another change that has been going on for almost a century. It is the gradual disappearance of the "Old Irish mare," which was so well suited to the Thoroughbred sire. She has been replaced by half-bred, three-quarter bred, seven-eighth bred, and often by mares with more of the Thoroughbred blood in their veins. These mares, as a result of their breeding, are much finer in bone and more deficient in point of substance than the mares formerly used. When this trouble appeared in the stock, various methods were resorted to with the hope of improvement. It often happened that the use of the Thoroughbred sire was abandoned, and a high-grade, called a "hunter" sire, or perhaps an "agricultural sire," was used. With the hope of furnishing some information which might be helpful, many of the of furnishing some information which might be helpful, many of the various methods will be discussed. Some of these have no other commendable feature than that they illustrate an example of a method not advisable to follow in the production of hunter horses.

THOROUGHBRED SIRE AND IRISH MARE.

The use of the Thoroughbred sire on the Irish mare was the original method employed by Irish farmers in the beginning of hunter-horse production in the country. From early photographs and paintings, as well as from brief descriptions by early writers, we are led to believe that the Irish mare belonged to a class of horses highly prized for general utility. These horses were used for all kinds of work on the farm and on the road. Their origin has been traced to the Spanish horse. They are described as being medium-sized, deep-bodied, clean-legged animals, capable of withstanding an unusual amount of hardship. When bred to a good strong Thoroughbred sire, the offspring, as a general rule, developed into useful animals, many of which made excellent heavy-weight hunters.

At the present time, scattered throughout the various parts of the country, are to be found many mares of a similar type. They are generally the progeny of the so-called "agricultural sire" and dams with a mixture of draft and Thoroughbred blood. Mares of this class

which have good strong legs, plenty of width and depth of body, and considerable quality, when crossed with a Thoroughbred sire which possesses plenty of bone and muscle, good depth of body, a strong back and loin, and good quality, are very highly prized for the production of high-class hunter horses. The greatest objection to this class of dams is that oftentimes, especially if there is much draft blood in the near ancestry, the progeny, while possessing the desired conformation, will lack endurance. Such hunters are designated as having too much " soft blood " or " cold blood " in their ancestry and do not wear well. Providing such dams have sufficient " warm blood " to insure good staying powers, they constitute the most highly favored foundation stock for the production of high-class, heavy-weight hunters from Thoroughbred sires.

THOROUGHBRED SIRE AND DRAFT MARE.

With the hope of producing a good hunter horse, many farmers have resorted to the use of the Thoroughbred sire and a grade draft mare. The mare may be a half-bred or three-quarter bred Clydesdale, Shire, or Suffolk. The results of this method have been, as a rule, very unsatisfactory. In the majority of instances the progeny, instead of being a happy medium between the sire and the dam in point of conformation, have had head and limbs resembling one parent and a body like the other. Such a cross was too violent to insure uniform results. Furthermore, the progeny produced in this manner, when they possessed the desired conformation, were seriously lacking, as a rule, from the standpoint of endurance. While the sire has been bred for generations from racing stock, the dam, on the contrary, has been bred from a class of horses intended to convey heavy loads at a pace seldom faster than a walk. The people generally who have practiced such methods of breeding had previously met disappointment from the use of an undersized Thoroughbred sire on half-bred or three-quarter bred mares. The result of the latter method was so deficient in point of size that they were oftentimes led to believe, for a while at least, that size was the chief requisite of a good hunter.

THOROUGHBRED SIRE AND CONNEMARA PONY DAM.

In certain localities in the western part of Ireland, where the soil is poor and vegetation sparse, the people use ponies to do what little farm work is required. Different districts have different types, each of which is known by the name of the county or district in which it is most largely used. The most popular class of these ponies is called the " Connemara," which is found in the district of that name and to some extent in Mayo. These ponies might quite properly be classed as small horses, as they are about 14 hands high on an average, and

seldom more than 14.2. They have wide, deep bodies, excellent feet and legs, and show every indication of possessing unusual strength and hardiness. They are descended from Arab, or Barb, blood and are very fleet-footed. Another commendable feature is that, as a class, they are remarkably free from unsoundness. With the hope of producing a more remunerative selling animal, Thoroughbred sires have often been used on the Connemara pony mares. When good strong sires were used the progeny proved useful animals, and in this manner some of the most hardy heavy-weight hunters have been produced. It was very difficult with this system of breeding to secure sufficient size; many of the offspring were small enough for polo ponies.

Hunting men claim that horses bred in this manner were very hardy. However, this method can not be recommended as reliable in the production of hunters, but it may be fairly successful to produce polo ponies.

THOROUGHBRED SIRE AND HALF-BRED MARE.

With the continuous use of Thoroughbred sires, the half-bred mare sooner or later will have to be used as a dam. While good strong half-bred mares have been largely used and many of the best heavy-weight hunters are produced in this way, much trouble has been encountered by the farmers in producing desirable stock. A great many of the half-bred mares are far from being suitable for this work. The most prevalent fault is their lack of size and substance. Many of these animals possessed fairly good bodies, but were very deficient when it came to the bone and muscle of their limbs. A deficient heart girth was also a common weakness. Those having sufficient size were too often coarse-boned, cold-blooded animals, and thus undesirable. The really useful half-bred mare was usually the result of a good strong Thoroughbred sire and the Irish agricultural type of mare. When bred in this manner the progeny usually possessed good size, fair quality, and considerable endurance. Such a type of mare when bred to a good, large Thoroughbred sire generally produced useful stock. The offspring as a rule possessed the desirable points of conformation which are demanded in the hunter, but hardly enough quality to meet the demands of the critical trade. The Irish farmers have too often used undersized Thoroughbred sires on this class of mares, the result being an undersized, plain-looking animal. When the small half-bred mare was bred to an undersized Thoroughbred sire, the majority of the progeny were just "weeds." It is by this general system of breeding that a large number of the cab horses are produced. They are the misfits, which too often are in the large majority and are not suitable for hunter purposes, and thus are sold at comparatively low prices to the hack and cab drivers.

THOROUGHBRED SIRE AND THREE-QUARTER BRED MARE.

Where good judgment has been observed in selecting useful half-bred mares and mating them with the very best type of Thoroughbred sires the female progeny have furnished one of the most valuable types of dams for the production of high-class hunters. When mated with the proper type of Thoroughbred sire—one that has ample heart girth and plenty of bone and muscle—the very highest type of hunter has been produced. It was in this manner that Moyglass, Gold Dust, and Lord Prosperous were produced. While many of the very best hunters have been produced in this manner, yet fully one-half of the farmers who have pursued this method have met with disappointment. These failures can be attributed to two common causes at least, namely, undersized dams and second-rate or third-rate sires. The results of such mating are noticeable on every hand in all parts of the country. They demonstrate, in an unmistakable manner, that there is a limit to which this grading work can be successfully carried on by the masses of the people. While the careful breeders, men who both breed and feed well, can get good results, the average man too often gets misfits as his reward. Many good breeders advocate this method. It may do for the careful man, but it is dangerous when practiced by the masses. Ireland can furnish ample evidence that such is the case, and her people are beginning to realize the need of a better method.

THOROUGHBRED SIRE AND SEVEN-EIGHTH BRED MARES.

In some sections of Ireland the seven-eighth bred or even higher-bred mares are used. It is possible to produce heavy-weight hunters by such breeding. In fact, those breeders who are very anxious for speed and high quality in the offspring quite often adopt this plan. It must not be inferred that high breeding is objectionable; far from it. The higher the breeding, the better the progeny, providing, of course, that size of bone, depth of body, and other essential points are retained. But it is right here where the trouble makes itself known. The Thoroughbred horse, as a class, is much too light in bone and general conformation to carry a heavy-weight rider over all kinds of soil and obstacles, such as are encountered in the hunts. This being true, we can readily appreciate the difficulties to be met with in the production of hunter horses when we approach very closely the pure Thoroughbred blood. While an occasional heavy-weight hunter of unusual quality and breedy appearance is produced in this manner, it must be regarded as one of the three or four prizes out of the hundred attempts, the remainder being blanks so far as this type of horse is concerned. It is largely a game of

chance when practiced by the masses, but when undertaken by a careful breeder much more satisfactory results may be obtained. This method furnishes a considerable number of medium weights and a still greater number of light-weight animals. On account of the higher breeding, resulting in better quality of the progeny, the better class of the misfits, from a hunter standpoint, find a very good market as light-weight riding horses. This is an important consideration, as in any line of breeding there is always likely to be some that will not measure up to the standard, and thus a fairly good market for the misfits is quite a consolation for the unfortunate breeder.

AGRICULTURAL SIRE AND HIGH-GRADE THOROUGHBRED MARE.

Many farmers have resorted to the use of the agricultural sire on high-grade mares. This has been done for the purpose of securing size in the offspring from these three-quarter bred and seven-eighth bred mares, which are often seriously wanting in size and general conformation. These agricultural sires, as a class, resemble somewhat the light draft type of horses. They are clean-legged, deep-bodied horses of medium height, being around 16 or 16.2 hands, and weighing from 1,250 to 1,400 pounds in fair flesh. Their breeding is of a variable nature, as no two of them are exactly alike in this respect. From the most reliable sources of information, the writer was led to believe that, as a rule, they contain a mixture of the blood of the draft horse, the Thoroughbred, and some of the old Irish breed of horses. While occasionally a desirable hunter has been produced by this method of breeding, the major portion of the progeny are much below the standard. The cross evidently was too violent to insure uniformity in the offspring, even if the parents were good. Such sires, on account of their mixed breeding, have generally shown a decided lack of prepotency. The horses bred in this manner are not well balanced from the standpoint of conformation, and are usually seriously wanting in quality and endurance. The misfits are not in very great demand, except at low prices, to be used as hack animals. Some animals of this breeding are selected for army remount purposes, but the progeny of the Thoroughbred sire and ordinary mares, and especially half-bred mares, are very much preferable for this purpose. The prizes resulting from such breeding are too few and the misfits too undesirable to warrant the adoption of the use of the agricultural sire on mares of the class mentioned.

HALF-BRED, OR HUNTER, SIRE AND IRISH MARE.

More than one-fifth of all the stallions in service in Ireland belong to a class called "half-breds" or "hunter" sires. The term "half-bred," as applied to this class of horses, is misleading, as it is doubtful

if there are any real half-bred horses used as sires. The name "half-bred" has been and is still applied to any sire which has some other blood than that of the Thoroughbred horse in his ancestry. Many of these so-called half-breds have five, six, or even more crosses of the Thoroughbred sire, thus containing little other than the blood of the Thoroughbred. They differ from the general run of Thoroughbred sires in that they are larger, stronger-boned, deeper-bodied, and more heavily muscled animals. While many of them show remarkable quality as a class, they are inferior to the Thoroughbred in this respect. As sires of useful hunters, they stand in very high favor with the majority of the farmers, but are more or less discredited by the breeders of Thoroughbred horses. It is not reasonable to expect such sires to possess prepotency in the same degree as would be present in a horse bred for generations in one line. These half-bred or hunter sires, when used upon the so-called Irish mares, have given general satisfaction. A large percentage of the offspring have developed into useful animals for hunting purposes. As a rule they do not possess quite so much quality as those sired by a Thoroughbred horse, but their conformation is so desirable that the average class of buyers considers them good enough for the general trade. In this system of breeding, quality is one of the points which must be observed closely, as it always adds to the appearance of the animals, and thus enhances the value considerably for the critical trade.

HALF-BRED, OR HUNTER, SIRE AND HALF-BRED MARE.

This method of breeding has been followed by many farmers with more or less success. In this system success in a large measure seems to be dependent upon the ancestry of the dam. If the dam has been a half-bred out of the Irish mare the results are usually quite satisfactory. When the dam contains considerable draft blood the progeny are not so good. While they generally possess size they are not well balanced in conformation and are usually seriously lacking in endurance and quality. While some good horses have been produced in this manner the results, as a whole, have not been very satisfactory, especially when the dams contained much draft blood in the near ancestry.

HALF-BRED OR HUNTER SIRE AND THREE-QUARTER BRED OR SEVEN-EIGHTH BRED MARE.

The use of the half-bred or hunter sire on three-quarter bred, seven-eighth bred, or higher bred mares is quite a common practice and is each year becoming more and more popular with the Irish farmers. It is on this method of breeding that the more progressive horsemen rely for the maintenance and future development of the hunter horse in Ireland. Many excellent hunters have been produced in

this manner, especially when good mares have been used, and the percentage of useful animals has been as high, if not higher, than from any other method practiced. One of the most gratifying features of this system of breeding is that it affords the farmers a means by which they can continue breeding hunters from the same foundation.

In addition to the numerous methods which have been mentioned others are practiced in a small way in the attempts to produce high-class hunter horses. The Hackney sire has been used to some extent on the various classes of mares. While a few useful-appearing hunters have been produced in this way, the method is not favored by the majority of horsemen. They claim that animals of such breeding, while attractive to the eye, are very "soft" when subjected to a test, which is the only reliable method of determining a horse's right to be classed as a model hunter. These methods have not been presented for the purpose of commending them to those who are aiming to engage in the production of this class of horses. They are given for the purpose of exemplifying the most common methods that have been and are still practiced throughout the various sections of Ireland. While some of them are objectionable in many respects, still they may be the necessary choice and not the most preferable one on the part of those who have adopted them. This line of work, like the majority of others, is often carried on under circumstances which are anything but favorable.

THE MOST RELIABLE METHODS FOR PRODUCING HUNTER HORSES.

For years the Irish farmers have resorted more or less to the indiscriminate use of the Thoroughbred sire. Those who were fortunate enough to secure the use of large Thoroughbred sires were generally successful in their work; but those who used undersized sires of this breed met with disappointment. Taking the Thoroughbred sires as a class, they have not been very successful. Sooner or later farmers who used such sires were forced either to abandon the business or else to get a new stock of brood mares, as their own mares, produced in the manner described, became too small to warrant their further use. It has been a costly but valuable lesson. The use of the large sire and the small mare or the small sire and the large mare has not been successful. It has proven to be largely a game of chance, so far as the production of high-class animals is concerned. The progeny seldom were of the desired happy-medium type. Too often they resembled one parent in one particular and the other in some other point and were unevenly balanced, which rendered them worthless as hunters. Furthermore, such work had no definite purpose so far as the future development and maintenance of the type was con-

cerned. After long years of experience the more progressive breeders are beginning to recognize the importance of affinity in type in both sire and dam to accomplish successful results; that uniform results could only be obtained and perpetuated when the sire and dam were of the same or almost the same type. Thus in the production of hunter horses it was necessary to breed from sires and dams which themselves possessed the conformation and substance demanded in the hunter horse. When breeding was carried on in this manner the progeny, when well fed and cared for, usually developed into high-class animals, fit to become hunters or to produce them. This much settled, the next step was to secure suitable sires and dams for breeding purposes.

SELECTION OF SIRES.

As to the sire there are but two sources from which the desired type has been obtained. One is the selected Thoroughbred, with abundance of strength, substance, and action. Such horses, unfortunately, are very rare, and great difficulty has been met in obtaining the proper type in any reasonable number. The other is the half-bred, or hunter, sire. These horses could be used for producing hunters, but the fact that they carry crosses of cold blood has operated against them to a certain extent, even if the bar sinister is far back in the pedigree. Except the Irish section in the Hunters' Improvement Society Studbook, there has been no means of registering such horses until the department of agriculture of Ireland began its work along this line. Most of the promising young stallions of this class have been castrated, as geldings bring as good or better prices than if they had been kept entire. With systematic registration of Irish hunters things would very likely be different, as then many of the desirable types of animals which have been previously gelded would be retained as stallions. Thus such recognition, in the opinion of many prominent breeders, would be of great benefit to the farmers of Ireland, as then there would be a sufficient supply of useful sires to meet the demand on all sides. The service fees of such sires would be within the reach of the small farmers. High-class Thoroughbred sires have been so rare that the fees for the use of the few which exist are very high and the small farmer does not feel warranted in paying them. In selecting a sire for the production of hunter horses the following points should be observed:

All the desirable qualities of the hunter, mentioned on pages 196–199, should be considered, and the standard should, indeed, be higher. The possession of certain characteristics is of so much more importance that they are mentioned at considerable length. In heighth and weight the standard of the heavy-weight hunter should be approached.

Popular opinion favors a medium-sized horse, rather low set than otherwise, with an abundance of bone and substance. A 16.1 horse will be used if he is not leggy or weedy. In weight, the best sires range from 1,200 to 1,300 pounds in good breeding condition.

Soundness is the most essential thing to be considered in a hunter sire. No animal should be selected for breeding hunter horses that is in any manner unsound or shows the slightest predisposition to unsoundness of any nature. The progeny of no other class of sire is subjected to such severe tests as that of the hunter. In the chase every joint of the horse is taxed to its utmost, and the breathing organs could not be subjected to a more severe trial. Unsoundness, in some of its various forms, has cost the farmers of Ireland many millions of dollars through the rejection of what otherwise appeared to be useful animals for hunting purposes.

After soundness, one of the most valuable features in a hunter sire is the power to get progeny with ample stamina and endurance. While there is but one sure method of determining his ability in this direction, and that is a test of his progeny in a chase, there are several points of conformation which are considered to be indicative of such power in the sire himself. Chest capacity, or heart girth, is one of the most essential points. While this will vary somewhat, according to the condition of the horse, yet the girth should be from 6 feet 3 inches to 6 feet 8 inches. The muscling of all parts of the body and limbs is another important point. In all parts the muscles should be hard and well developed, and especially over the loin and on the forearms and gaskins, as these portions are subjected to hard work. The size and quality of the bone in the cannons is another point which must not be overlooked. Good-sized cannons in front should measure from 8¼ to 9 inches below the knee. These are rough measurements worth keeping in mind at all times.

Quality is also highly important. It not only indicates the wearing capacity of the horse, but adds to his money value by improving his appearance.

In addition to these points, the horse should have the marks of masculinity which indicate the good breeder.

SELECTION OF BROOD MARES.

The selection of the brood mare is an important question, but one which can not be controlled to the same extent as in the case of the sire. While sires are, or at least always should be, selected for a definite purpose, brood mares, as a rule, vary much in accordance with the nature of the farm work and the class of horses previously bred in the district. Thus there always has been and likely will be wide difference in the type of dam used, especially until the desired

type becomes well understood and fairly well fixed. Where the right kind of sires are used and good judgment practiced in selecting the best fillies, this difficulty will become less and less noticeable in breeding operations. Under existing conditions, especially when so many types are used with more or less success, it is not possible to present a definite detailed description of what the mare must be like in conformation. Suffice it to say that the more closely she approaches the description previously given of a typical heavy-weight hunter, the more uniform and desirable will the progeny be likely to be from a hunter standpoint.

In addition, the characteristics of femininity should be strongly in evidence, especially in a sweet, refined head, a well-formed neck, with clean-cut throttle and windpipe. The mare should have as few faults as possible, because these may be perpetuated in her offspring. There should not be the slightest inclination toward unsoundness of any kind, and strong knees, hocks, cannons, fetlocks, pasterns, and well-developed feet are very essential. Depth of chest and width of body are indispensable, as without strong development in these points no mare can be expected to bring forth a strong foal. The body should be roomy, with deep, well-sprung ribs and wide, strong loins. The quarters should be wide and long, giving a roomy pelvis which insures easy parturition.

The most desirable brood mares are those having two or three crosses of Thoroughbred blood. Animals of such breeding and possessing the desirable points mentioned usually give good results when mated with a high-class hunter sire. While all the progeny thus bred do not by any means develop into desirable heavy-weight hunters, a larger percentage are satisfactory than from any other method of breeding. Those which do not meet the requirements of a hunter usually find a fairly profitable market as cavalry remounts—a class of horses which is in very strong demand in Great Britain and the Continental countries.

FACTORS WHICH HAVE BEEN DETRIMENTAL TO HUNTER-HORSE BREEDING.

Any report on hunter-horse breeding that does not make brief mention of some of the factors which have been detrimental to the business is incomplete and misleading. While Ireland has achieved an enviable reputation in the production of high-class hunter horses, it must not be inferred that no difficulties have been undergone by her people in this work. On the contrary, in certain districts, and to some extent throughout the entire country, much disappointment has been suffered. Investigations were inaugurated by the British Government and special commissions were appointed to visit the various districts for personal inspection, also to hold special sessions

at which farmers, breeders, and horse dealers who dealt in local or foreign trade were invited to be present for the purpose of giving such information as they might possess pertaining to the causes of the trouble and also suggestions for removing these causes. The farmers presented their side, the breeders or stallion owners had also a chance, while the dealers were able to give much useful information pertaining to the objections of the foreign buyers to the various classes of horses produced.

TOO MUCH THOROUGHBRED BLOOD.

In all parts of the country there is a strong feeling among the farmers that too much Thoroughbred blood has been used for the best interests of the industry; that the continued use of this has been responsible for the production of a large percentage of undersized and, in many instances, almost worthless horses. That there have been and are at the present time a great many undersized horses can not be questioned—animals that are so seriously wanting in size, constitution, bone, and muscle as to render them unprofitable to their producers. Personal observation leads the writer to venture the assertion that it has been the injudicious use of the Thoroughbred rather than too much of it that has led to such disappointing, and in some instances disastrous, results. The fact that many of the very best hunter horses have been sired by Thoroughbreds has led many people to believe that anything and everything out of a Thoroughbred sire should make a high-class hunter horse. Consequently, Thoroughbred sires have been used with little or no discrimination so far as size, constitution, and other points so necessary were concerned. The continued use of such sires on second-class and third-class mares could not prove otherwise than a disappointment. Where Thoroughbred sires of the type and conformation of those illustrated in this article have been used the results have been highly satisfactory, but the majority of the Thoroughbred sires used in Ireland are themselves too light for heavy-weight hunters. This being true, good results can not follow their use on small mares. It is but fair to say that the greatest of care in selection is very necessary in the use of Thoroughbred sires; also that the offspring of such horses require liberal feeding and good care until they reach maturity if the necessary size is to be retained.

THE USE OF UNSOUND SIRES.

One of the greatest drawbacks to hunter-horse production in Ireland has been the continued use of unsound sires. It has been a very common practice among an objectionable class of horsemen (which is far too numerous for the good of the people) to import broken-down horses which, on account of some unsoundness of conformation or

wind, have been discarded from English racing stables and breeding establishments, and to distribute them throughout the various parts of the country. Such sires have always been widely advertised as noted race horses, which, in addition to a comparatively low service fee, tempted large numbers of small farmers to select them for breeding purposes. The Irish farmers, like those of most other countries, have too often regarded a low service fee as being one of the commendable features of a sire. While the fees of many of the better sires were not within their reach, it certainly would have been a much better investment for them to have paid a liberal fee for the use of a good sire or to have given up breeding entirely rather than to use an unsound sire. It has been an expensive schooling, but many of them have been taught the valuable lesson that a sire is just as prepotent in transmitting his undesirable features as the desirable ones to his offspring. There were to be seen many examples of yearling and 2-year-old colts from such sires with large bone spavins, curbs, ringbones, or unsoundness of wind. While sound sires are essential in the production of any class of horses, they are especially needed in the hunter horse, which in the course of his regular work is subjected to trials almost unknown to horses of any other class.

THE USE OF COLD BLOODED SIRES.

When disappointed from the use of one type or class of sires, many farmers resorted to the use of another, and perhaps the very opposite in type. When the Thoroughbred failed to get size enough in the offspring, an agricultural or grade draft sire was often used. Sometimes the Hackney or some other coach type of horses was selected. The results of such work were generally far from satisfactory. The offspring were generally badly balanced, in that they resembled one parent in one respect and the other in another. They were also seriously lacking in endurance, containing as they did too much cold blood. The introduction of one such a cross often lowered the standard of the horses of the district for many years, even after the correct type of sires was used. The real cause for this mixed breeding and introduction of miscellaneous sires was the fact that no definite type of sire and dam had been established for the production of hunter horses. Crossing was the prevailing practice. While judicious crossing gave very good results, yet the too general use of it in an indiscriminate manner proved to be disastrous. No better illustrations of the need of a well-defined type of sire and dam could be cited than those referred to in this connection.

BEST MARES SOLD TO FOREIGN COUNTRIES.

It is impossible for any country to sell annually the best of her fillies to foreign buyers and still continue to produce a large per-

centage of good horses. Those in a good position to know claim that there is a smaller percentage of useful brood mares in Ireland at the present time than there was a quarter of a century ago. This is due to the fact that foreign buyers, especially during recent years, have looked the country over for the best young mares and fillies. As a result of this demand the farmers usually retain second-rate and third-rate animals for breeding purposes, and too often those with some hereditary unsoundness. With such mares for dams nothing but the very highest type of sires could be expected to get offspring with even good average merit. The more progressive farmers and breeders are beginning to realize the importance of retaining a large proportion of their best young mares and fillies for their own use. When this method becomes more prevalent it will bring about a wonderful and much-needed change in horse production.

BREEDING FROM IMMATURE DAMS.

When the influence of the foreign demand for young mares made itself known many breeders recommended that the farmers should breed their fillies at two years old and have them rearing their first foals as 3-year-olds, so that at least one foal from each of these young mares might be secured before they left the country, as foreign buyers preferred mares 4 years old or those rising 4. While this might have been good theory, it has not proven to be a good practice. In the hands of the average farmer both the mare and the progeny were seriously injured, so far as size and proper development were concerned. The mare seldom developed sufficient size, while the progeny were always small and often badly proportioned animals. It is possible that such a method might be successful in the hands of a good feeder who would give the mare a rest the next year and feed both her and the progeny liberally on such feeds as would promote good growth.

The above-mentioned factors have been most prevalent, but no doubt others have existed which have been responsible for more or less failure on the part of farmers in this work. That any or all of these detrimental features could be eliminated can not be doubted. They are not features that belong solely to hunter-horse breeding, for similar illustrations are found, more or less, in the breeding of all classes of animals everywhere.

FACTORS WHICH HAVE BEEN BENEFICIAL TO HUNTER-HORSE BREEDING.

Recognizing the importance of the horse industry and the many natural advantages which the country had for this line of work, the Government, through its various forms of organizations, has, especially during recent years, expended large sums of money for the purpose of educating and encouraging tenant farmers in this line of

work. Few if any other countries have such work so well in hand as has Ireland at the present time. While it requires time to bring forth results in breeding operations, the influences of the work already done are making themselves known on every hand.

ROYAL DUBLIN SOCIETY.

The oldest organization which has been instrumental in this work is the Royal Dublin Society, which was organized by a few of the more progressive citizens of Dublin in 1731 and had for its object "the promotion of improvement of all kinds." While this society has been interested in all lines of work, it has been of untold value to the hunter-horse industry of Ireland. In 1868 it held its first annual horse show. This feature of its work has grown from year to year so that at the present time it is justly entitled to be classed as the greatest show of hunter and riding horses held in any part of the world. By offering liberal premiums for Thoroughbred sires, suitable to get weight-carrying hunters; for brood mares of the proper conformation and substance, calculated to produce heavy-weight hunters, and for the various classes of weight-carrying hunters, it has induced efforts by horse owners and breeders in all parts of the country to bring their best to this show. In addition, it has made its place with the people in all parts of Ireland, so that horsemen now look forward to it as the event of the year. It is so well conducted in every detail as to render it of great educational value to the people. For years farmers and breeders from all parts of the country have attended this show for the purpose of learning more about the proper type of sire or dam to use in the production of hunter horses and to study closely the conformation of the most highly approved hunter horses and the demands of the trade. These exhibitions have done much for the horse industry. In addition to this annual show, which is always held during the latter part of August, the society for many years held an early spring stallion show for the purpose of awarding premiums to the best Thoroughbred sires. These spring shows have been of great value. Coming, as they do, just before the breeding season opens, farmers are able to obtain hints that are fresh in their minds when the question of selecting a sire presents itself.

DISTRICT AND COUNTY SHOWS.

The good work of the Royal Dublin Society's shows made itself felt in another direction. While many people attended these annual shows held in Dublin, a large majority of the smaller farmers were unable to do so, therefore district and county shows were organized for the benefit of these people. The district shows brought out the best horses from the several county shows, and in a sense were grad-

ing grounds from which the better animals later on appeared at the Royal Dublin Society's show. The county shows have done much in the way of encouraging better brood mares and young stock, as these classes have always been much stronger, comparatively, than the same classes at the larger shows, while the entries of sires and finished hunters were smaller. This was due to the fact that the brood mares and young stock, in the opinion of their owners, were not highly fitted enough to make a good showing at the larger shows. Thus all the shows have been helpful to the general development of the industry. These shows have not only been of great benefit in demonstrating the most approved types of sires, dams, and young stock to interested spectators, but they have also stimulated a desire on the part of those who have exhibited to produce better animals. The county shows are aided by Government grants, upon the recommendation of the Irish department of agriculture.

WORK OF DEPARTMENT OF AGRICULTURE OF IRELAND.

The Irish department of agriculture, which was organized in 1899, has already done a most valuable work in hunter-horse improvement as well as in the various other branches of the live-stock industry. With a good staff of workers and a large sum of money at its disposal, it has already reached the people in all parts of the country. So far as the work of this department relates to improvement in hunter-horse production, it can best be presented under the five headings, namely, registration of Thoroughbred stallions, nomination of mares, premiums for Thoroughbred stallions, loans for the purchase of Thoroughbred stallions, and methods of establishing a type of hunter horse in Ireland. A discussion of these subheadings will convey a fairly good idea of the general plan of the department's effort to encourage horse breeding.

(1) *Registration of Thoroughbred stallions.*—One of the most successful and practical lines of work undertaken by the department is the scheme for the registration of Thoroughbred stallions. It was outlined and adopted for the purpose of preventing, so far as possible, the introduction of worthless sires, and as a guide to farmers in making selections of sires best suited to the needs of their mares. Animals eligible to registration must pass an inspection by experts on their general merits, and by veterinary surgeons on soundness. The inspection for general merit and fitness to get the desired type of stock is carried out by one or more inspectors appointed by the department. This includes an examination of the stallion's general conformation, of his offspring, if he has been bred, and any other points that might be deemed advisable in determining his suitability as a sire. Having satisfactorily passed the examination of the department inspector,

he is then subjected to a veterinary examination conducted by one or more veterinary surgeons appointed by the department. No stallions shall be rejected as unsound unless suffering from one of the following diseases: Cataract, roaring, whistling, ringbone, sidebone, unsound feet, spavin, and curb.

No stallion is inspected by the department officials unless he is registered in Weatherby's Stud Book, is 3 years old or over, and the owner agrees to accept for service to the horse, providing he passes inspection, not less than 20 and not more than 50 nominated mares. Furthermore, stallions accepted for registration will be registered for particular districts only, and can not, without the written consent of the department, be removed to another district. Any violation of this rule will cause the animal in question to be dropped from the list.

Any stallion owner may have his stallions inspected free of charge by filing an application with the secretary of the department of agriculture on or before the 30th day of October preceding the breeding season in which they are to be used. Applications filed at a later date must be accompanied with a fee, ranging from $5 to $25, in accordance with the time of year at which it is received by the department. The only exception to this rule is in the case of imported stallions which are purchased before the 31st day of March. Such horses are examined free of charge. Furthermore, intending purchasers of horses in England, after they have inspected the animals and completed all arrangements for the purchase, are granted free inspection of such sires in England by the Irish department inspectors. This has been done for the purpose of encouraging the importation of useful sires. Although this work is still new, it is highly favored by the farmers and better class of horsemen. Great care has been observed in making the selections, and high standards of excellence have been adhered to in all instances. In 1903, 123 Thoroughbred sires were awarded department certificates. This is a good showing for the third year's work. The figures for 1904 are not yet available, but when published they will show a material increase over those given above. This form of work is driving out the scrub horses and owners of such animals from the breeding business, as farmers in all parts of the country are demanding sires registered by the agricultural department. It is also a practical and most effective method of educating stallion owners to appreciate the need of good, sound sires.

(2) *Nomination of mares.*—While the registration of good, sound sires has been an excellent thing, in that it served as a guide in making selections, yet many small tenant farmers were not able to avail themselves of the use of such animals, on account of fairly high service fees. In addition to this fact, many were not able to select sires suitable to the needs of their mares. This being true, the

department has inaugurated another line of work, which has met with great success. This is the system of nomination of mares. A certain number of mares belonging to tenant farmers are selected in each county, and the owners granted nomination tickets to the value of $10 or $15 per mare, which can be used as credit in payment of service fees, the department reimbursing stallion owners to the extent of the value of the nomination tickets for mares bred to their horses. The owners of such mares are required to breed to stallions registered by the department. Although the nomination ticket may not be sufficient to meet the full fee of such a horse, it reduces it to such an extent as to bring it within the reach of these small farmers.

During the months of February, March, and April of each year, upon consecutive dates and at certain fixed places which have been well advertised for at least five weeks before the date of the exhibitions, one or more exhibitions of farmers' mares are held in each county for the purpose of issuing nomination tickets. All mares entered at these exhibitions must be the property of tenant farmers whose holdings come within a certain maximum allowance and who is also a resident of the county. In making the selections all mares are inspected by department experts as to conformation and suitability for such breeding and by veterinary surgeons for soundness. No mare is awarded a nomination ticket that does not come up to the standard of conformation and is also free from all hereditary forms of unsoundness. The entire number on exhibition are examined and graded in order of merit, on which basis the nomination tickets are granted. The preference is given to desirable young mares under 6 years of age. This is not done in the belief that mares of such an age are better breeders than older mares, but for the purpose of encouraging the farmers to retain their best young mares for breeding purposes. Not more than one nomination ticket is granted to one farmer, except when the desirable mares are too limited in number to fill the nomination list for the county. Exacting rules have been adopted to prevent any misuse of the tickets granted.

When awarded a nomination ticket, the farmer selects from the list of registered sires in his county his first and second choices and forwards them to the department of agriculture. In case the list of his first choice is not already full he is granted the use of it, but should that list be full he is given another choice whose list is not full. In the year 1903 there were 1,792 nomination tickets granted to farmers in the various parts of Ireland for the use of Thoroughbred sires. This work has already done a great deal of good. It has stimulated an interest in good horse breeding and a desire on the part of the small farmer to retain his best mares for breeding purposes.

(3) *Premiums for Thoroughbred stallions.*—In executing its work the department has had to encounter many difficulties. The equal

distribution of suitable sires in the various counties had to be solved. While one county had more than a sufficient number to meet the demand, some other county would not have enough to meet the needs of the people. This difficulty has been partially overcome by awarding liberal premiums, amounting to $500 each, to stallion owners as an inducement for them to stand one of their sires which was registered by the department in some county which did not have a sufficient supply of its own. The awarding of such a premium did not alter the amount of the service fee, but served as an inducement to send the horse into a new territory. This scheme has been very helpful to many of the less progressive counties.

(4) *Loans for the purchase of Thoroughbred stallions.*—To further assist in solving the difficulty previously mentioned concerning the scarcity of desirable sires in certain counties, the department inaugurated another plan which has given good results. Under certain conditions, approved applicants (either individuals or associations) may secure loans from the department for the purchase of stallions. This is only done in those counties where there is not a sufficient number of registered sires. Before granting a loan the department must approve the animal to be purchased and the price to be paid, and the intending purchaser or association must insure the animal in question for the full amount of purchase price in some reliable live-stock insurance company and deposit the policy with the department, must pay one-third of the purchase price of the horse, and furnish suitable bonds for the remaining two-thirds, which is loaned by the department at $2\frac{1}{2}$ per cent per annum and to be paid, with interest due, in five equal annual installments. The department also reserves the right to inspect the horse at all times until he is paid for by the purchasers. Should there be any doubt in the opinion of the department as to the care and attention which the horse is having they can remove him elsewhere. This form of aid has been drawn upon by many counties and is regarded quite satisfactory.

(5) *Recognition of hunter sires and establishing hunter type of horse.*—During the present year (1904) the department has inaugurated a line of work which has for its purpose the establishment of a distinct type and eventually a breed of hunter horse. The greatest care has been exercised in outlining and executing the initial work. A careful examination of the so-called half-bred horses has been made and 12 of the best have been chosen as suitable animals for registration under the departmental regulations. A work of such importance must of necessity be carefully conducted, and to all appearances every precaution to guard the best interests of the plan is receiving the attention of those in charge.

METHODS OF FEEDING AND MANAGEMENT.

In a discussion of the methods of feeding and management of hunter horses as practiced in Ireland it must be stated at the outset that there is no such thing as uniformity of details in this work. Different people practice very different methods in their attempts to accomplish the same end, namely, the development of a good horse. Notwithstanding this fact, there are certain phases of the work common to all parts of the country. Furthermore, the fundamental principles of the methods in vogue on the most successful farms are, when compared, very much the same. In this connection a general review of the methods practiced, with special attention given to those of the more successful breeders, will be presented.

THE FEEDING AND MANAGEMENT OF THE STALLION.

The stallions, as a rule, receive considerable attention. They are well fed and generally fairly well exercised. The stable accommodations are very good, each horse having a roomy box stall which is warmly constructed, generally of stone, and well bedded. Earthen floors are the most prevalent, but in some instances cobblestone is used. On some farms exercising paddocks are connected with each stall, but the most common practice is to have an exercising lot in which each animal is allowed a certain amount of time each day. These lots are usually long and narrow rather than square. With long and narrow exercising lots there is much less danger from accidents than is the case in square lots, where the horse can run in a circle. Some horsemen, however, prefer having their stallions walked or ridden a certain distance each day. The Irish horsemen are strong advocates of plenty of fresh air for their breeding horses. They also believe in abundant exercise, claiming that it develops and hardens the muscles of their stallions, thus rendering them more useful sires of hunter horses. In some instances sires are even used in the hunts, but this practice is very rare at the present time. After the breeding season is over the rations of the horses are reduced, especially so far as the grain part is concerned. Succulent feeds, such as fodder crops, roots, and mashes, are used instead of the hay rations. The mashes consist of bran, crushed oats, and a small allowance of roots, all steamed and fed in the evening. For the grain part of the ration oats and bran are used. It is a rare thing to find any other grain than oats used. Sometimes barley in the steamed form is fed in small quantities, but it is not used as a regular grain feed. Corn is never fed to stallions. Horsemen claim that corn is too much of a fattening and heat-producing ration to be used as a feed for breeding animals; that when corn is used it is next to impossible to keep the blood in good condition, and that sooner or later it will cause trouble

in the legs; that even with the use of barley the greatest of care is necessary, and the animal must receive more exercise than is necessary when oats and bran are fed. For roughage long hay in moderate quantities, about 10 or 11 pounds per horse per day, is used, but many horsemen prefer good, clean, well-cured clover hay to all other kinds, as it has a favorable influence on the digestive organs. During the winter season mashes and roots are fed, but are gradually reduced as the breeding season approaches, as all horse owners are anxious to have their stallions in firm flesh—not soft and flabby—when the breeding season opens. Mashes are fed three times per week during the winter, and consist of crushed oats and bran for horses in good condition. Horses that are not in good condition usually get a small allowance of oil cake in connection with their mashes. Long hay of mixed variety is used, and the amount is reduced somewhat in quantity and more grain is fed. The grain ration consists solely of oats and bran, and from 12 to 16 pounds per day are fed, in accordance with the size, condition, and work of the horse. During the breeding season the stallion is regularly exercised and fed liberally on oats, bran, and long hay. Regular grooming is practiced at all seasons of the year. On every farm visited the owners strongly recommended liberal feeding of natural feed stuffs, such as tended to keep the system of the animal cool, regular exercise, and plenty of it, as being the essential features of the successful management of a stallion. In no instance were any of the stallion owners feeding condiments of any kind, and all considered the use of such articles as not only unnecessary, but dangerous when fed to stallions.

THE FEEDING AND MANAGEMENT OF THE BROOD MARE.

There is more diversity in the methods practiced of managing the brood mares than in the case of the stallions. This is due to the fact that on the majority of the farms the mares are required to do the most of the work. On some farms, however, the brood mares are not worked at all, but this is the exception to the general rule. Where the mares are not required to work, they are usually allowed to graze throughout the entire year, except in the case of severe storms and for a few weeks previous to and after foaling time when early foals are reared. After the foal is weaned and during the early winter months, no additional food is given except when the supply of grass is short. When the supply of grass is not sufficient, some oats or oats and bran are fed. For a short time previous to foaling time, a small allowance of oats or oats and bran is usually fed. While suckling the foal, the general practice is to give no feed except what the mare is able to gather in the pasture lot. In some instances a little crushed oats and bran are fed throughout the entire suckling period, but this practice is not common.

The mares that are used for the regular farm work, in addition to rearing foals, are handled in a very different manner. The busiest seasons of the year on the Irish farms are the spring, summer, and early fall months. With more than four-fifths of the entire country under grass we can understand that the tilling of the soil is not a very heavy task. Furthermore, the nature of the soil is such as to render the work very light, and thus there is less heavy farm work than is usual where the land is more difficult of cultivation. These conditions are all very favorable from the standpoint of working the brood mare. The amount of work usually demanded of such an animal is not much more than good exercise.

During the fall and winter months, after the foal has been weaned, these mares are grazed the greater part of the time, especially when not at regular work. Even when worked, it is the custom to allow them the run of a grass lot at night. In addition they are fed liberally on oats—sometimes bran and oats. As the foaling time approaches they are given very good care and are liberally fed on good mixed or clover hay, morning and evening, with oats and bran for the grain ration. When not at work and the weather conditions are favorable, they are allowed the run of a grass lot during the day, as in this way they get regular exercise and sufficient grass to keep them in good health. This method of treatment, with more or less light work, is practiced up to foaling time. They are then furnished a roomy box stall and are given about a week's rest before being put to work again. During the suckling season the mares are well fed on crushed oats and bran. In some instances the foals are allowed to run with the mothers while at work, while others prefer keeping the foals confined during the day and allowing them to run with the mothers on a grass lot during the night. Excellent results have been obtained by this system of regular work and liberal feeding. Under the existing conditions in Ireland it has much to commend its general use. In this manner the brood mares, in addition to doing the regular farm work, rear, on an average, about two foals every three years, which is very helpful to these small farmers. Both the dams and the progeny appear to be in good condition, and from what could be learned colts produced in this manner developed into as useful horses as those from idle mares.

THE FEEDING AND MANAGEMENT OF THE FOAL.

One of the most vital points to be observed in the successful production of hunter horses is the proper care and nourishment of the foal. While good breeding is indispensable, good feeding and management are of equal importance, as the size and conformation of the horses are more or less determined by the proper and continuous nourishment of the animal while young. This is especially true

since the general tendency for horses of this class is to be undersized; thus every effort should be made to promote regular, uniform growth from the date of birth until maturity. All successful breeders strongly emphasized this point, and stated that in their observations poor feeding of young animals, especially after weaning time, had been the cause of much disappointment on the part of small farmers in their efforts to produce useful hunter horses.

The best farmers and breeders practice the grain feeding of foals, in addition to the mother's milk, from the time the foal is about three weeks old. Personal observation leads the writer to believe that the best horses are started in this manner. It has not been found a difficult task to teach the foal to eat some finely crushed oats and bran, especially in the case of those foals whose dams are regularly worked. At the beginning but very little of such feed is given. As the foal grows older and becomes larger the amount is gradually increased until at 4 months old from 3 to 4 pounds are fed daily, in accordance with the condition of the colt and the amount of milk furnished by the dam. This grain ration, in addition to the mother's milk, produces a strong, well-developed, vigorous foal, which, when weaned from its mother at 5½ or 6 months old, grows right along without any setback. After weaning, the foal is fed its regular allowance of grain and, in addition, has the run of a grass lot during the day and a comfortable, well-bedded box stall with some good hay to eat during the night. This method is practiced during the more favorable fall months.

Special attention is given to the wintering of foals. Shelter and warmth are regarded as being fully as important as good feeding. Allowing foals to run out all winter is regarded as being a fatal error, as it usually causes the foal to get a setback from which it seldom recovers. While abundance of fresh air and out-of-door exercise are given during favorable weather, yet comfortably bedded, warm box stalls are highly recommended for night use and during unfavorable weather. The winter rations consist of a liberal allowance of good mixed hay for roughage and crushed oats and bran for the grain ration. Some of the most successful horse producers feed a small allowance of oil cake in connection with the crushed oats and bran. Sometimes foals which are not thriving well are fed a mash of cooked turnips, bran, and crushed oats about twice a week.

THE FEEDING AND MANAGEMENT OF COLTS AFTER THEIR FIRST WINTER.

The summering of yearlings that have been well wintered is not a difficult task. The common practice is to allow them a good run on grass, with plenty of fresh water at all times. Nothing additional is given, as the grass alone not only produces good growth of bone and muscle, but also maintains a good condition of flesh. Few countries

are so fortunate as Ireland from the standpoint of grass production. A moist climate insures a good supply at all times, but of more importance still, from a horse-producing standpoint, is the quality of the grass produced from the limestone subsoil. This grass is rich in mineral matter, and thus young horses grown upon this soil are noted for the size and quality of their bone. Such natural conditions are very beneficial in the development of young horses. The methods employed in the wintering of yearlings are similar to those in the case of foals, the principal difference being that yearlings can stand more exposure and thus remain out of doors more. In this manner they are grazed a considerable portion of the time, especially during favorable weather. For roughage the usual feed is mixed hay, but clean clover hay is fed on many farms. The grain ration consists almost solely of oats; in some instances bran is also given. Animals that do well receive no other feed, but those that are thin receive mashes about twice per week and sometimes oil cake, the main object being to keep them growing well and on the cheapest ration possible, as foodstuffs are usually scarce.

The summer and winter management of 2-year-old colts is very simple. During the summer months they are grazed on good grass and furnished plenty of pure water. This system of grazing is practiced throughout the major portion of the winter season, especially when the weather is at all favorable and the grass supply sufficient. At other times mixed hay and straw are fed, but grain of any kind is seldom given, except to thin colts. Thus, as 2-year-olds they are given but little care and very little feed aside from what they gather themselves. When they arrive at the age of 3 years more care and attention are demanded if retained on the farm. At this age, however, a great many farmers dispose of their colts to dealers and farmers who make a business of training them for sale. This is especially true in the fall of the year when the colts are 3½ years old. There is always a considerable foreign demand for such animals. From this time on they must be better fed, as more or less training must be done. It is very important that these young animals should be well halter broken, used to the bit, saddle, and other such things. When this training does not commence at 3 years of age or even before, much difficulty is usually encountered in accomplishing it. It often happens that an otherwise good horse is ruined from a hunter standpoint by being allowed to run too long before an attempt is made to train him. No horse can be classed as a desirable hunter that is not well broken.

DEVELOPMENT AND EDUCATION OF HUNTERS.

Good manners and good disposition are most essential features in this class of horses. They are of the first importance when it comes

to the selection of a horse for this kind of work. The man in a chase has no time to spend on educating his horse to pass obstacles. While much time is usually required to educate a horse properly, yet there is little or no uniformity of method pursued in this work. Each man has his own ideas as to the best manner of accomplishing this end. This is usually done by the boys and young men. On those farms where boys are scarce the colts are usually sold at 3 or 3½ years of age. There are always plenty of buyers for such animals. The training consists of teaching the animal the use of the bit and saddle at first. When this is accomplished the animal must be taught to jump fences, ditches, and to pass obstacles of all kinds. Other points, such as getting them accustomed to hounds, is accomplished in many ways. The principal points are those mentioned, namely, the free use of the bit and the saddle and the jumping of all kinds of obstacles that are usually encountered in the course of a hunt. While a horse is not considered sufficiently mature to withstand the hardships of hunting until he is 5 years old, many are purchased and used for some light work in their 4-year-old form. This is due to the difficulty which hunting men find in securing desirable horses of a more mature age, and thus they are compelled to purchase the younger animals and partially grow them for their own use.

The Irish farmers, breeders, and especially horse dealers fully understand fitting and preparing their horses for sale purposes. Nothing is left undone, either in the line of grooming or feeding, which will enhance the value of an animal. They are offered in the pink of condition. The attractive skin, with its coat of silky hair, is usually the result of judicious feeding of steamed mashes of oats, barley, bran, and oil meal, in addition to the regular hay-and-oat ration. Hand rubbing of all parts of the body also plays an important part in securing the desired end. The tails are always squared, manes pulled, and legs neatly clipped.

SOURCES OF DEMAND FOR HORSES OF HUNTER TYPE.

The Irish people are fortunate in having a ready market for all surplus horses. Those of the highest type are purchased for hunting, while animals bred along the same lines but deficient in size or quality are used for other demands at smaller prices. By this system of breeding some half a dozen or more classes of horses are produced for which there is a foreign demand at very good prices. They might be divided as follows: Weight-carrying hunters (heavy, medium, and light), mares and fillies for breeding purposes, saddle horses, officers' remounts, troopers' remounts, harness horses, and hack, or cab, horses.

WEIGHT-CARRYING HUNTERS.

The most valuable and also the most difficult class of horse to produce is the weight-carrying hunter. This class is divided into three subclasses according to their size and substance, and thus their ability to carry weights. While there is a strong demand for all three of these classes at substantial prices, the highest prices are always secured for those animals belonging to the heavy-weight class. Good heavy-weight hunters with lots of quality and good manners command from $800 to $2,500. Such animals must be thoroughly broken, "good lookers," "fast goers," and "long stayers." Young horses from 3 to 4 years old, possessing the conformation and quality desired in this class of animal, sell for from $400 to $600 in their green state.

Thus such horses prove profitable investments to both the producer and the trainer. Medium and light weight hunters, when well trained, command from $500 to $1,500, depending upon their substance, quality, and manners. Young horses of the type, quality, and conformation necessary to make good medium and light weight hunters sell in their green state for prices ranging from $200 to $500. While some of these horses are used by hunting men in Ireland, the majority go to England, Scotland, and Continental countries.

MARES AND FILLIES FOR BREEDING PURPOSES.

Good young mares and fillies of the desired type, conformation, and quality demanded in the weight-carrying hunter horse are in strong demand for breeding purposes. While many countries purchase some of these animals, Germany affords the best market. This is due to the fact that the German Government is very desirous of having a strong military remount system and, so far as possible, to produce all their horses within their own country. Thus, instead of annually importing animals for military purposes, they are importing female stock to be used by their own people in producing useful home-grown horses. German buyers pay regular visits to the Irish horse shows and fairs for the purpose of selecting the best young mares from 3 to 6 years of age. Mares of the proper age command from $500 to $1,000 each, in accordance with the amount of quality, substance, and size which they possess.

SADDLE HORSES.

There has always been a very good home and foreign demand for saddle, or riding, horses. Such horses must show quality, fair size, good style, nice disposition, and good manners. For this class of animals there is a strong demand at fairly remunerative prices. The prices are certainly good, since the animals are really misfits in the breeding of hunter horses. Such animals command from $175 to $500 each. The highest prices are usually obtained for well-

trained horses showing nice style and action and suitable for ladies. Such animals in their green state command from $150 upward.

ARMY REMOUNTS.

There is a regular and growing demand for army remount horses. This includes the demands of the British army and those of practically all the European countries. The best demand comes from several of the European countries, which pay the highest prices. Prices for horses of this kind are, to a certain extent, fixed, and those countries with the highest limits are always in a position to get the best animals. Two grades of horses are demanded for this purpose. The best class are the horses used by army officers. Such animals must possess fair size, good conformation, fair quality, and considerable speed. Horses which do not show enough breeding for hunters are often sold as officers' remounts. The prices vary in different countries and range from $200 to $315. They are purchased when 4 years old, do not require special training, and can be bought directly from the breeders. The second class, that of trooper remounts, are animals of fair size and strength. The more Thoroughbred blood they contain the better, but usually they are the result of mating a Thoroughbred sire and a grade draft mare or an agricultural sire and a high-grade Thoroughbred mare. Such animals usually sell at $140 to about $195 when 4 years old. Many farmers find them fairly profitable animals to produce. Such horses could certainly be produced to better advantage in a range country.

HARNESS HORSES.

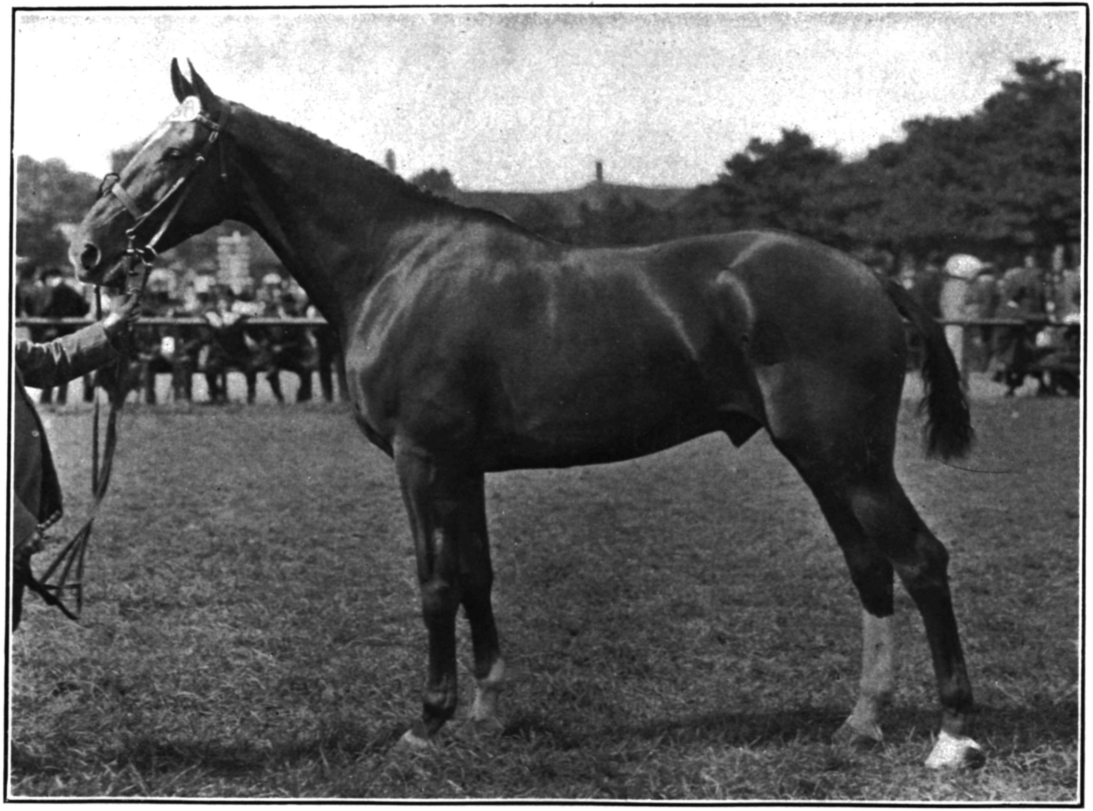
In the production of hunter horses there is always a fair percentage which make useful harness animals. This class includes those which are too rangy for hunter purposes. From a harness-horse standpoint they show remarkable quality and finish, good style, fair action, and wonderful endurance. Compared with horses of coach breeding, the hunter-bred horses are generally lacking in that high knee and hock action which is so much sought for by many horse fanciers. On the other hand, they possess a long, easy stride, which renders covering long-distance journeys an easy task. Their value in the harness-horse market varies much in accordance with the demand. Where high-actioned horses are wanted, hunter-bred horses, as a rule, sell at comparatively low prices, but when free, easy, and graceful drivers are wanted they sell at premium prices. The general range of prices will vary from $200 to $1,000 each, according to the breeding and quality of the horses and the market demands.

CAB AND HACK HORSES.

This includes the misfits and blemished or unsound animals. The prices are low and vary in accordance with the supply and demand.

Description of Plate 8.

This illustration represents Moyglass, winner of first prize in a class of over 70 heavy-weight hunters, the hunters' champion cup for the horse best suited for a hunter (competition open to all classes), and the Coote challenge cup for the best weight-carrying hunter, mature or immature, in all the heavy-weight classes at the Royal Dublin Society's show in 1904. He is a chestnut, 5 years old, and was sired by a Thoroughbred. Somewhat more substance all through would improve him, but from the standpoint of quality and finish, few if any better heavy-weight hunters have been exhibited in many years.



Heavy-weight Hunter Gelding Moyglass.

Description of Plate 9.

Fig. 1.—This illustration represents Gold Dust, who won first prize in an unusually large and strong class of medium-weight hunters and the hunters' champion cup at the Royal Dublin Society's show in 1903. He was a horse of great substance in all parts, of medium height, and very good quality.

Fig. 2.—Bonny Morn, winner of first prize in a class of more than 100 entries for medium-weight hunters and Samuel Ussher Roberts's challenge cup for hunters bred in Ireland at the Royal Dublin Society's show in 1904. This is a handsome chestnut horse, with plenty of substance and quality to warrant him a place in the best of medium-weight hunters.

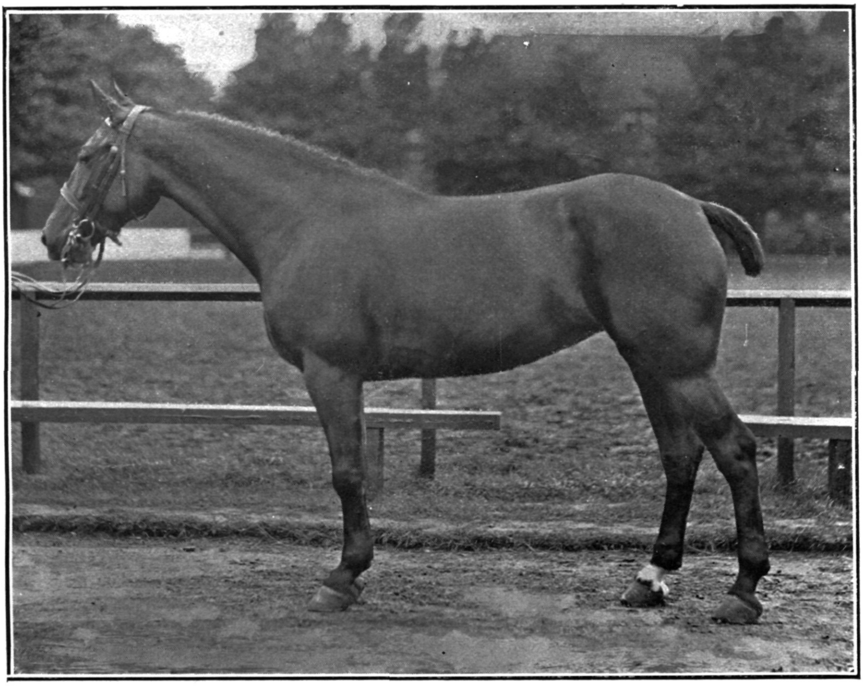


FIG. 1.—MEDIUM-WEIGHT HUNTER GELDING GOLD DUST.

FIG. 2.—MEDIUM-WEIGHT HUNTER GELDING BONNY MORN.

Description of Plate 10.

Fig. 1.—This illustration represents Speck, the first-prize winner in a class for young horses suitable to become medium-weight hunters at the Royal Dublin Society's show in 1903. She is pronounced by good judges as being an exceptionally strong medium-weight mare, having ample substance to carry her weight.

Fig. 2.—This illustration represents the promising 4-year-old gelding Lord Prosperous, winner of first prize in a strong class of young horses suitable for heavy-weight hunters, also reserve to Moyglass for the Coote challenge cup at the Royal Dublin Society's show in 1904. He is an exceptionally good young horse in most respects and has wonderful quality.

FIG. 1.—MEDIUM-WEIGHT HUNTER MARE SPECK.

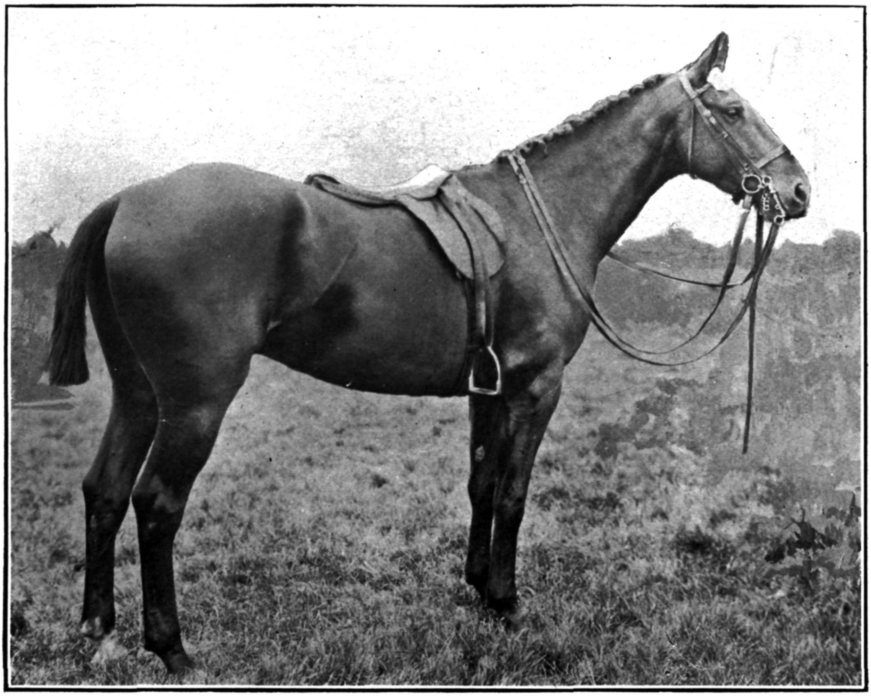


FIG. 2.—FOUR-YEAR-OLD HEAVY-WEIGHT HUNTER GELDING LORD PROSPEROUS.

Description of Plate 11.

Fig. 1.—This is a very good illustration of General Peace, winner of first prize in the class of Thoroughbred stallions suitable to get weight-carrying hunters, and the Croker challenge cup for the best stallion of any age at the Royal Dublin Society's show in 1904. He is a most attractive looking 10-year-old brown horse, and has won a great many valuable races in his day. He girths well, has muscular back and quarters, stands on short legs, has almost 9 inches of bone below the knee, unusual quality throughout, and is considered by good judges to be the right stamp of a horse to breed weight-carrying hunters. It is but fair to say that while this horse has the desirable qualities of a high-class hunter sire, he has never been used for this purpose. His unusual breeding, individual excellence, and his success on the race course have won for him such a strong admiration among the breeders of race horses that his service fees are not within the reach of the average farmer. He is allowed but 40 mares per year, at a fee of $250 per mare.

Fig. 2.—This is a good likeness of Royal Mask, winner of first prize in the class for Thoroughbred stallions suitable to get weight-carrying hunters, and the Croker challenge cup at the Royal Dublin Society's show in 1903, and winner of second prize at the same show in 1904, when he was beaten by General Peace. This horse is a chestnut in color, and possesses wonderful substance. He is a typical hunter sire. Few horses show stronger development of bone and muscle in all parts. In point of quality and finish he is surpassed by General Peace. Royal Mask, while used chiefly as a sire of Thoroughbred stock, has sired many good hunters. If his fees were within the reach of all classes of farmers, few horses would be in more popular demand.

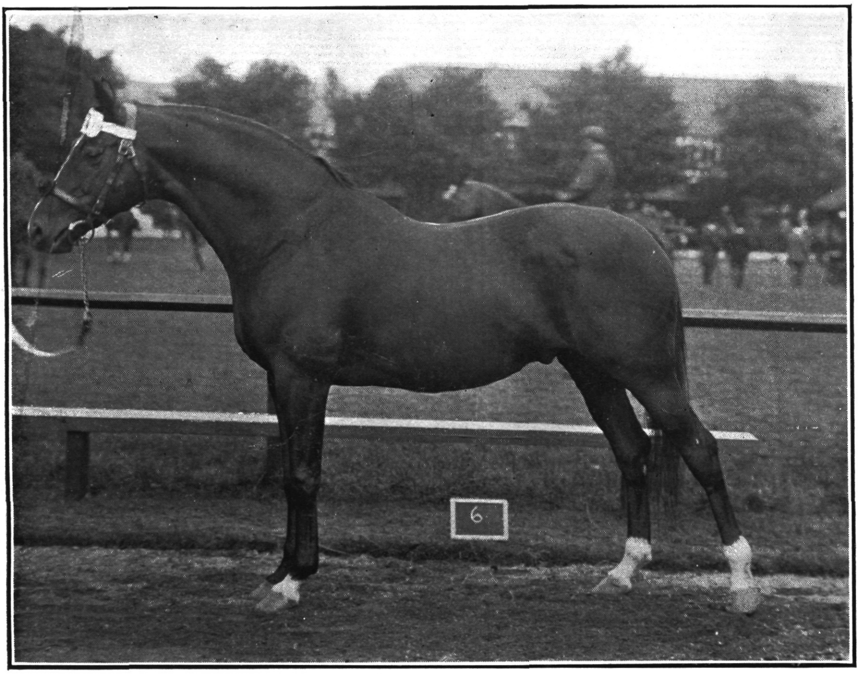


FIG. 1.—THOROUGHBRED STALLION GENERAL PEACE

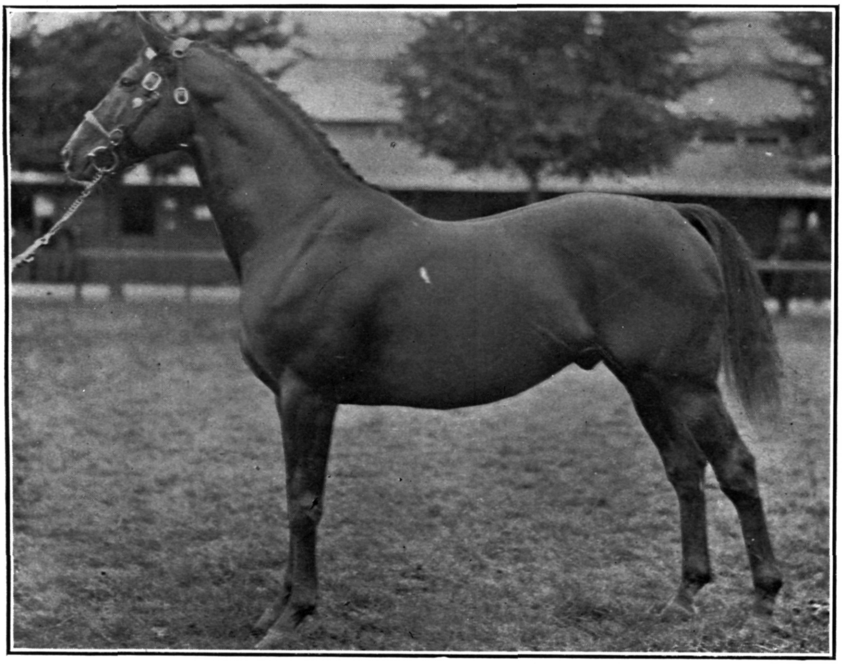


FIG. 2.—THOROUGHBRED STALLION ROYAL MASK.

Description of Plate 12.

Fig. 1—This is a fairly good representation of Red Prince II, who won first prize in a strong class of Thoroughbred stallions suitable to get weight-carrying hunters, and the Croker challenge cup at the Royal Dublin Society's show in 1902, and was second in class to Royal Mask at the same show in 1903. Few if any other sires of hunter horses are more highly appreciated by horsemen than Red Prince II. While used in his owner's stud as a Thoroughbred sire, he is also used freely as a sire of hunter stock. His wonderful depth of body and strength of back and loin are seldom equaled in a sire of Thoroughbred blood. He has ample bone and is unusually well muscled in both fore and hind legs. He has also very good quality for a horse of his age. Being in his teens and having done hard service, his knees are a bit " over " now. Barring this defect, it is doubtful if he has an equal, in point of conformation, in all Ireland.

Fig. 2.—This is an excellent likeness of the famous hunter stallion Merry Matchmaker, winner of several first prizes and gold medals at the leading English shows. He is registered in the Hunter Improvement Society Stud Book of England, which was organized for the purpose of developing and establishing a hunter breed of horses. This horse was sired by a Thoroughbred stallion and out of a mare whose racing performances, soundness, and conformation were sufficient to warrant her registry in the Hunter Improvement Society Stud Book. Merry Matchmaker is a perfect model of what a high-class hunter sire should be. He possesses the style, quality, size, and substance that are so necessary in the make-up of a typical hunter horse. In point of heart girth and bone and muscling of the legs he has few equals. He is an excellent type to keep in mind when selecting a hunter sire.

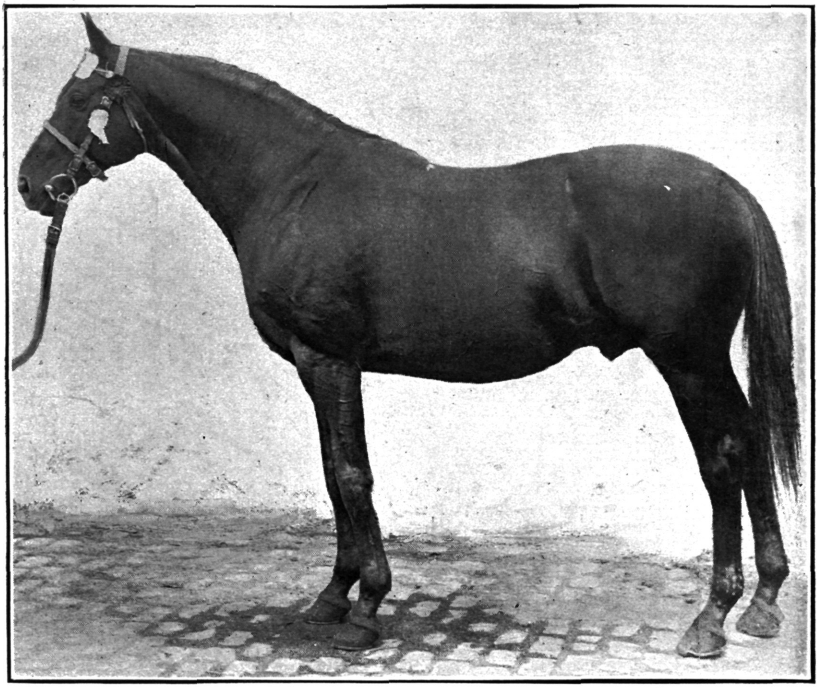


FIG. 1.—THOROUGHBRED STALLION RED PRINCE II.

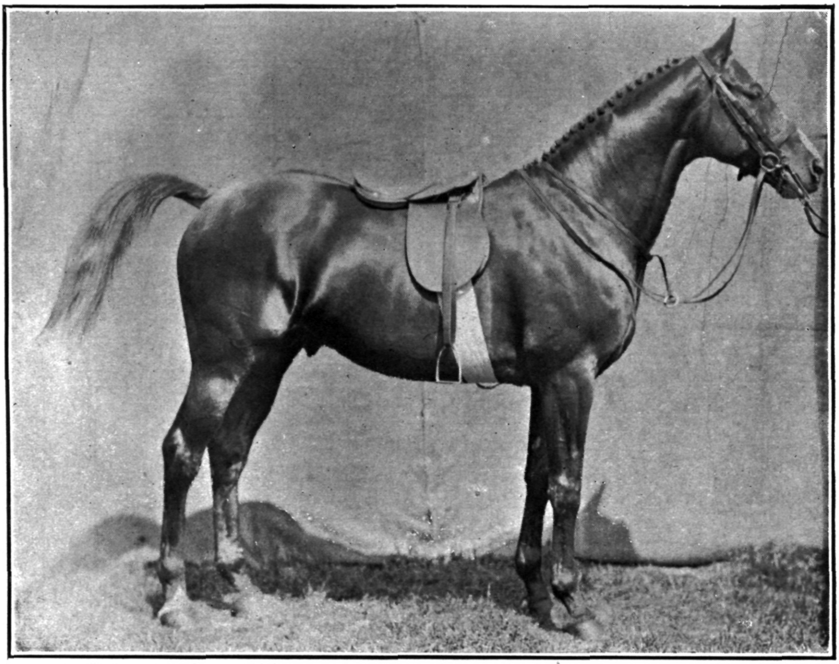


FIG. 2.—ENGLISH-BRED HUNTER STALLION MERRY MATCHMAKER.

Description of Plate 13.

Fig. 1.—This is a fairly good likeness of the Irish-bred hunter stallion Ballymena, a famous prize winner at the leading Irish and English shows. He is also registered in the Hunter Improvement Society Stud Book of England. He was sired by a Thoroughbred stallion and out of a weight-carrying hunter mare. His dam was twice a winner at the Belfast show in a class open to mares up to 210 pounds' weight. This illustration does not do him justice, as one of his front legs is shown badly placed. He is a good, strong horse in all his parts, especially in the bone and muscling of his legs. In point of quality and depth of body he is not the equal of Merry Matchmaker.

Fig. 2.—This is an excellent illustration of the famous prize-winning mare Grey Pullet. She has on several occasions headed the class of mares suitable to produce weight-carrying hunters, and also won challenge cups at the Royal Dublin Society's show. She is especially strong in her depth and width of body and in strength of bone and muscle in fore and hind legs. Her progeny have been unusually good from a heavy-weight hunter standpoint. Taking her as a whole, she is of a type that commends itself to all horsemen as being an excellent utility animal. From what could be learned of her breeding she is the result of two Thoroughbred crosses on the Irish mare, thus making her a three-quarter bred. Many reliable breeders were free to class her as being the best type of a hunter dam in the country.

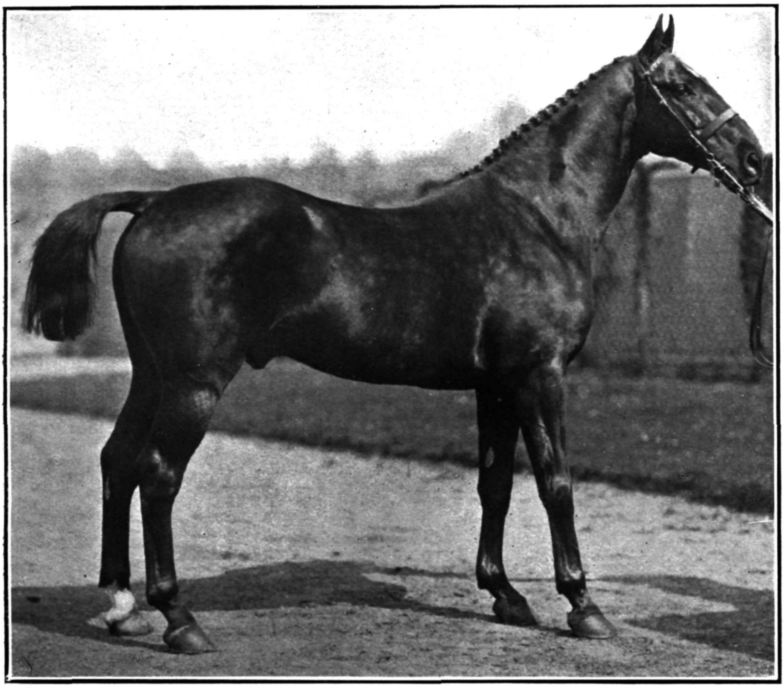


FIG. 1.—IRISH-BRED HUNTER STALLION BALLYMENA.

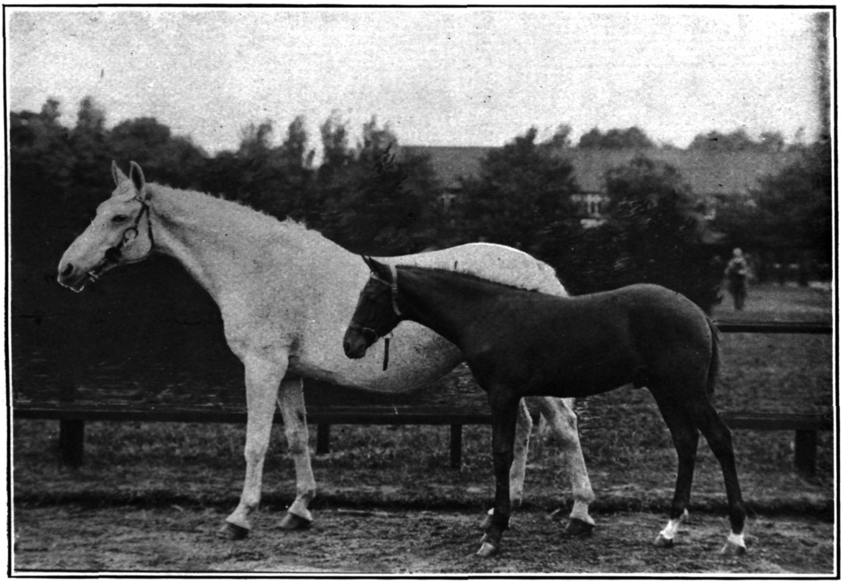


FIG. 2.—HUNTER BROOD MARE GREY PULLET.

Description of Plate 14.

Fig. 1.—This is a very good likeness of Royal Blood, winner of second premium in the class of mares over 6 years old suitable to produce weight-carrying hunters, at the Royal Dublin Society's show in 1904. She is a mare of quality and finish, but somewhat lacking in support beneath the knees. Aside from this, she could not be severely criticised. She is an excellent producer, as her foal headed his class at the same show in keen competition. When mated with the right kind of a sire she is a most useful mare; but compared with Grey Pullet she does not possess the substance, as indicated by heart girth and the bone and muscle development of the limbs.

Fig. 2.—This represents Maid of Orleans, winner of first prize in the class for mares 6 years old and under calculated to produce weight-carrying hunters, at the Royal Dublin Society's show in 1904. This useful young mare is but 4 years old, and her filly foal, which is her first, won highest honors in her class. Maid of Orleans is a well-bred mare, shows good quality, and is considered to have fair bone and muscle for her age. While a good animal, she does not class with either of the aged mares when uniformity of conformation is considered.

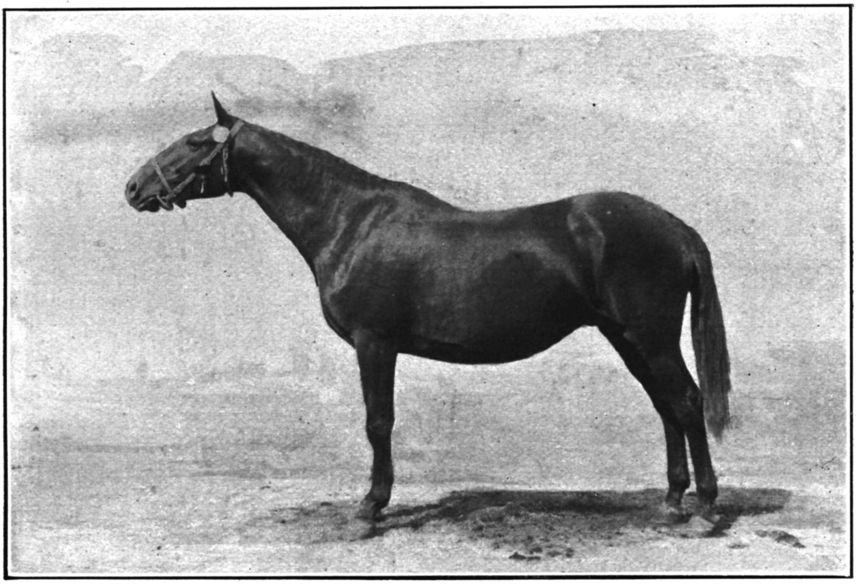


FIG. 1.—HUNTER MARE ROYAL BLOOD.

FIG. 2.—FOUR-YEAR-OLD HUNTER MARE MAID OF ORLEANS.

Description of Plate 15.

Fig. 1.—This illustrates Lady Tacitus, winner of first prize in a good class of mares 6 years old and under, possessing hunter conformation and bred to a Thoroughbred sire, at the Royal Dublin Society's show in 1904. She is a handsome bay 4-year-old, with black points. From the standpoint of conformation, quality, and endurance she measures up well. She is a three-quarter bred.

Fig. 2.—This is an excellent likeness of the 3-year-old filly Star of Ross, winner of the Pembroke cup for the young hunters bred in Ireland, at the Royal Dublin Society's show in 1904. This young three-quarter bred, in point of body conformation and bone and muscling of legs, shows a development rarely equaled. In the estimation of competent judges, her equal has not been produced in years in Ireland. At the recent show she was strongly admired by foreign buyers, and offers of an almost incredible size were refused, as her owner desired to keep her in Ireland. She is of the right type and affords an excellent model for study.

Fig. 1.—Four-year-old Hunter Mare Lady Tacitus.

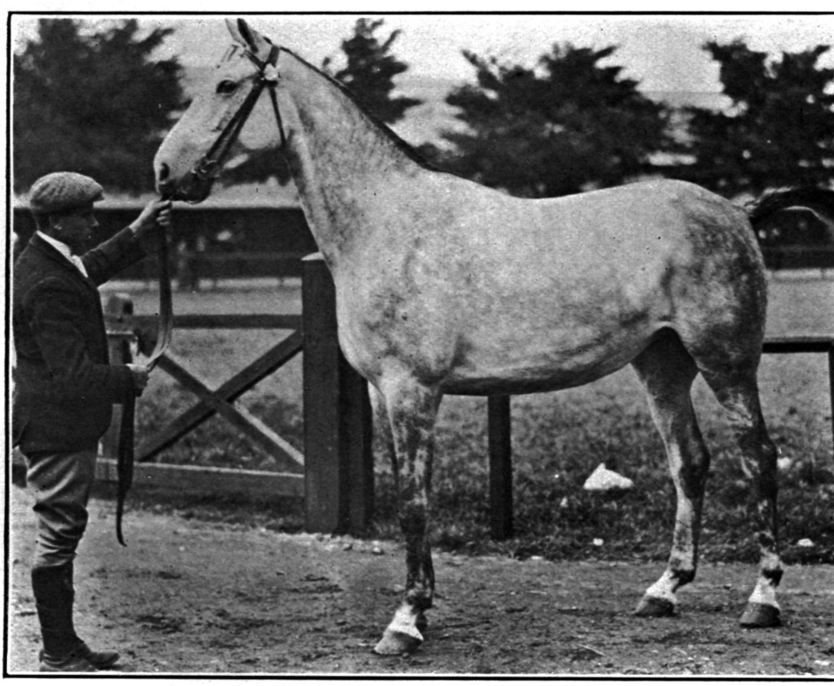


Fig. 2.—Three-year-old Hunter Filly Star of Ross.

HIGHLAND CATTLE.[a]

By John Roberts,
Editorial Clerk, Bureau of Animal Industry.

From all accounts it appears that comparatively little is at present known about Highland cattle in the United States, and not much interest in this picturesque old breed has hitherto been manifested by our people. Inasmuch, however, as the Highland breed has some sterling points in its favor as a beef breed, it seems fitting that our farmers and stockmen should have some information concerning its history and characteristics. This breed furnishes a striking example of the effect of climatic conditions in forming a distinctive animal. The Highlander is the creature of a land of mountains and rough heaths, a great part of which is about as bleak and wild a country as can be found anywhere in the Temperate Zone. When it is considered that it was formerly the custom on many Highland farms to turn the cattle loose all the year round without other food or shelter than what was provided by a country of this description, it will be seen that a race of animals famous for hardiness must have resulted. Indeed, the Highlander may justly be termed the champion "rustler" of the cattle kingdom. It is said that he can pick up a living under conditions where other cattle would starve, and he literally carries his roof on his shaggy back. Altogether he should be rated a prominent example in his line of the useful and ornamental combined, as he is admittedly the most picturesque of the domestic animals and at the same time profitable to handle commercially, in the right localities, because of his hardy nature.

It will be gathered from the foregoing that the foremost characteristic of the Highland breed is its hardiness, and it deserves attention on this score alone. When, in addition, it is claimed that these cattle produce beef of the choicest quality, it will be apparent that they may be of much economic value in those parts of the country which are in any way similar to their native environment. Such localities no doubt exist in some of our Northern States.

In this connection it may be suggested that it is more than possible that climatic conditions eminently suitable for Highland cattle are to

[a] Acknowledgment is made to Duncan Shaw, secretary of the Highland Cattle Society of Scotland; James Cameron, of Dundee, and others, for information furnished for this article.

be found in Alaska, particularly in the southern portion thereof. The sloping shores of this vast territory, together with the numerous islands adjacent, are said to abound with an almost unlimited amount of succulent forage. The proximity of the ocean to all this natural herbage renders the latter the more accessible and also causes the winter temperature of the region to be much less severe than it is inland at the same latitude. It is likely also that these cattle, owing to their active nature, rugged constitution, and strong bones, might, in addition to furnishing beef, be made very useful as work animals for this region.

When we contemplate the rapid westward trend of our cattle-feeding grounds during the past fifty years, it seems no idle fancy to predict that before many decades are past—certainly within the present century—one of the main sources of our beef supply is likely to be this same northerly territory of ours, the importance of which, from an agricultural point of view, is at present much underrated and unappreciated.

ORIGIN AND HISTORY OF HIGHLAND CATTLE.

While authorities differ as to whether or not Highland cattle were aboriginal in Scotland, some asserting that they were and others that they were not, it is known that a number of the large landed proprietors have maintained goodly herds in pure form from time immemorial, both on the mainland of the north of Scotland and in the adjacent islands to the west. The claim is also made that these cattle have preserved their ancient characteristics in a greater and more uniform degree than any other breed of cattle in Great Britain.

In the first volume of the Highland Herd Book, a yellow bull, Seillein (481), is registered as having been calved at Balranald (in the Western Isles) in 1806, and a black son of this animal, Morchuis (365), calved in 1810, is also entered in the same volume. The herd that produced these animals is said to be the oldest of the breed in existence. The Macdonalds have occupied Balranald in unbroken succession since the fourteenth century, and it is a family tradition that the cattle have always existed there. Some of the oldest mainland herds are at Poltalloch and in the Breadalbane and Trossachs country. The herd at the first-named place is said to have been founded in 1790. It is an interesting fact that there are records[a] going as far back as 1822 of the annual awards to Highland cattle at Highland Society's shows.

Formerly, owing chiefly to the restricted means of travel, there were two distinct classes of the breed, namely, the West Highland, or

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[a] See the Highland Herd Book, Vol. III, Appendix C.

Kyloe, native to the Western Isles of Scotland, and the Highlander, or Mainland Highlander, native, as its name implies, to the mainland of the north of Scotland. Nowadays this distinction has been largely, if not wholly, done away with.

The herdbook of the breed was started in 1884 at the Highland and Agricultural Society's centenary show held at Edinburgh in that year.

CHARACTERISTICS OF THE BREED.

The form and general appearance of the Highland cattle denote extreme hardiness. The shaggy Kyloe is, perhaps, more typical in this respect than his brother of the mainland. The latter, owing to greater care in rearing, superior feeding, and pasturage, and possibly some admixture of Shorthorn blood, usually attained a larger size than the island cattle; but the Kyloe's rougher life gave him far the grander hair and horn, and, having been raised solely on nature's succulent herbs and grasses, his flesh was accounted superior, thus showing how domestication and high feeding gave weight at the expense of quality. It is likely also that inbreeding for color contributed in some measure to the dwarfing of the island cattle. In former times these cattle were nearly all black. The reasons for this selection of color are given elsewhere (p. 231).

The toughness of the Highland breed may be illustrated by mentioning the fact that out of a total of 406 cows, heifers, and calves offered at the annual pedigree sale of Highland cattle held at Oban, in October, 1903, no less than 49 of the cows were over 9 years old, and 1 was over 16 years old. The authority for this is found in the report of the subsequent annual meeting of the Highland Cattle Society, the statement having been made on that occasion. Another still more remarkable individual instance of this kind occurred at the Melfort (a well-known Argyleshire herd) dispersal sale, in May, 1904. One of the lots was the famous dun cow Orag (1390), a typical example of the old stamp of Highlander—deep, short-legged, with great bone and quality, broad back, deep quarters, and fine hair and horn. This cow, although 18 years old at the time, was nursing a heifer calf.

Thomas Farrall, of Carlisle, England, in a paper on the West Highland breed, published in the Transactions of the Highland and Agricultural Society of Scotland for 1876, states, regarding the characteristics of the breed:

> Perhaps no cattle are possessed of more distinctive and strongly marked features than the West Highlanders. The following marks or characteristics stamp the genuine breed: Their limbs are short, but muscular; their chests wide and deep; their ribs well developed and finely arched, and their backs as straight as in the purebred Shorthorn; their neck and dewlap are somewhat coarse in the bull, but this is indicative of its mountain state; their horns of

good length, without approaching to the coarseness of the longhorns of the lower country, spreading and tipped with black; and all the other points are what the breeders call good. There is, indeed, much in the West Highlanders to arouse attention and win the admiration of those who love to see animals in an undomesticated state. The beautiful and imposing color of brindle, dun, cream, red, or black; the finely arched ribs and level back; the deep and well-formed chest; the splendid horn; the lively, quick, and fearless eye; the broad muzzle, and the shaggy coat impart to the Kyloes charms which are not to be found in any other British breed.

POINTS OF THE BREED.

The various points of the breed as given in the first volume of the herd book, under the authority of the editing committee at Inverness, Scotland, in 1885, are as follows:

THE HEAD.

Of all the representatives of our British bovine breeds the Highlander has the grandest and most picturesque head; it is indeed to his head that he owes his great favor among artists. As a rule, it is most proportionate to the body of the animal and is broad between the eyes, while short from the eyes to the point of the muzzle. The forelock between the eyes should be wide, long, and bushy, and any nakedness or bareness there is certain to detract from the appearance of the animal. Some would almost have the hair so wide there as to obscure the eyes, but this in many cases would be allowing one good point to overshadow another. The eyes should be bright and full and denoting, when excited, high courage. When viewed sideways there should be a proportionate breadth of the jawbones readily observable when compared with the width of the head in front, while the muzzle should, when looked at from a similar point, be short, though very broad in front, with the nostrils fully distended, and indicating breeding in every way. One of the most noteworthy features in a Highlander is, of course, the horns. In the bulls the horns should be strong and come level out of the head, slightly inclining forward and also slightly rising toward the points. Some, however, do not care for this rise, though any drooping is considered to be a very bad fault when between the crown and the commencement of the curve, as this is generally accompanied by a low, weak back. Some, too, are of opinion that the masculine appearance is slightly detracted from when the horns rise directly from the crown. This, however, can only readily be detected and commented upon when particular animals are brought before experienced judges, as within a show ring.

As regards the horns of the cow there prevail two opinions. As a rule, they come squarer out from the head than in the male, rise sooner, and are somewhat longer, though they preserve their substance and a rich reddish appearance to the very tips. The lack of the appearance of substance, or "sappiness," about the horns of the male would be very much against the animal in the show yard. The other taste is that for a female the horns of which come more level from the head, with a peculiar back-set curve and very wide sweep. A large number of enthusiastic breeders seem to prefer, by comparison, the latter, which gives possibly the more graceful appearance. In all cases, however, the horns of a Highlander, when well set, give the animal a stamp of nobility which causes it to attract the attention of any stranger who might pass heedlessly by animals of other breeds as merely cows, bulls, or oxen.

THE NECK AND SHOULDERS.

The neck should be altogether clear and without dewlap below. It should form a straight line from the head to the shoulder in the cow, but in the bulls should have that distinct crest common to all animals of the bovine species. This crest should come gracefully down to the roots of the horns, and, being well coated with wavy hair, the masculine appearance of the animal is fully completed. The shoulder should be thick and should fill out greatly as it descends from the point to the lower extremity of the forearm.

BACK, BODY, AND HIND QUARTERS.

From behind the shoulder the back should be fully developed and beautifully rounded. Any slight sinking or hollow is most decidedly objectionable. It should also, as in the Ayrshire, be as straight as possible, and the ribs should spring boldly out and be both well rounded and deep. When measured across the hips the breadth should be very great and the quarters should be exceedingly well developed from the hips backward. The thighs should also be well developed and should show great fullness. Viewed generally the quarters should be square between the hips and the tail and from between the tail right down to between the hind feet. The legs, both before and behind, should be short and strong; the bones strong, broad, and straight; the hoofs well set in and large, and the legs well feathered with hair. The animal should be set wide between the forelegs and it should move with great dignity and style, as this is considered to be one of the most reliable evidences of careful and true breeding.

HAIR.

The hair, of which there should be a great profusion, more particularly on the parts indicated, should be long and gracefully waved, very much as in what dog breeders denote wavy-coated retrievers. To have a curl is to possess a decided fault, and one which has of late years become unfortunately too common in some folds. This has been attributed in some quarters to a growing desire to make Highlanders grow big from feeding them higher and housing them more. At any rate, experience goes far to prove that the more exposed they are the greater the profusion of the hair and the less its tendency to curl. Thus the reason of the island cattle being always so much better haired than the mainland cattle is owing to their never being housed in winter.

The usual colors are black, brindle, red, yellow, and dun, and there is considerable difference of opinion among breeders as to which is preferable. In general, as to color, it may be said that a good herd should possess a mixture, avoiding always all those which indicate unhealthy thrivers. The thickness of the skin, as in all fattening breeds, comes in for a considerable amount of attention, but it has to be borne in mind always that the Highlander has been adapted by nature to withstand great exposure.

Regarding the color of the Highland breed, it may be said that in times gone by cattle from the North and West Highlands used to be spoken of in general terms as "Black cattle." The farmers of these localities preferred the black color, as they considered it indicative of hardiness, believing that animals of this color had stronger constitutions than the others, and that there was, in consequence, more profit in them. This predilection for black, however, is now a thing

of the past. In these early days it used to be a common sight at the market centers where West Highland cattle were wont to be brought to see quite a sprinkling of reds and duns among the prevailing blacks. The choicest of the duns, creams, reds, and brindles were rapidly purchased by agents who supplied the demand for the parks of English noblemen. Owing to the striking general appearance of these cattle, this demand for ornamental purposes was quite important; some, indeed, held the opinion that in this respect the cattle were handsomer than deer.

Variety of coloring has always been popular with the mainland breeders, but occasionally a certain color will become more or less fashionable for the time being. As an instance of this, it may be mentioned that yellow has recently been the popular color with buyers.

FEEDING AND MANAGEMENT.

The soil of the Highlands is generally of a loamy character, composed largely of sand and gravel; clayey soils are rare. The climate, though not so cold in winter as in the interior of the lowlands, is much more stormy and wet and has less warmth in summer. The rainfall, particularly in the Western Highlands, is very heavy. The winters are long, there being little new vegetation until May; June, in fact, is considered the first month of the grass season.

Highland cattle are active, hardy animals which forage well on scanty pasture. A hundred years ago the average Highland farmer gave little heed to the welfare of his cattle, and few of them ever received a mouthful of dry provender during the winter or spring. Sad indeed was often their plight during prolonged snowstorms; also in the late winter and early spring, before nature began to put on her new garb. They then had to subsist upon the decayed gleanings of the previous summer's herbage. In these times cattle that had survived a particularly severe winter might be seen in early spring huddled together like lean and hungry wolves, with staring coats and sides almost clapped together. The soil afforded them no sustenance until the grasses of the valleys began to spring up, yet in about three months after the grass season set in the best of them would be quite plump and fleshy, having acquired quantities of newly laid-on beef that was unsurpassed for tenderness and flavor.

In these early days the wasteful policy of insufficiently stocking the pastures in summer in order that some remains might be left for holding the cattle over the winter was generally adopted, with the resulting loss in both provender and cattle. A writer in 1803, commenting on the losses of Highland cattle every spring because of this neglectful treatment, suggested an economical remedy, which con-

sisted in making hay out of certain coarse grasses and forage plants which the cattle did not eat in a green state—other more palatable grasses then being plentiful—but which would be relished in a dry state when other food was scarce, thus preserving both forage and cattle at little cost.

Later, as rents became less easy to make up and the price of beef became higher, this wasteful policy in managing the cattle was partly abandoned. Pastures were divided out and portions set aside for winter use, the pastures on the heights being used in midsummer. During periods of snow in winter the farmer might be seen making his way through the storm with a bit of coarse hay for his famishing stock. It was found that the cattle did fairly well if they had some natural shelter during winter storms and a little hay, or straw even, to tide them over periods of privation.

Nowadays, of course, still more economical methods are in vogue. The modern husbandman—and he of the Highlands is as "canny" as the rest of them—knows that it does not pay to allow any checking or stunting in his growing animals. They must therefore be kept in thrifty condition throughout the winter. This is found to be an easy and inexpensive matter with Highland cattle.

The author previously quoted—Thomas Farrall, of Carlisle—said, in regard to the system of management practiced at the time he wrote (1875):

The present system of management varies very much in different districts and with the size of the herds; indeed, in the same district and under the same climatic and local influences the modes of managing the cattle in winter are somewhat different. Some of the small herds in Argyll and Perth are divided into two sections, the breeding cows being placed in one fold and the young cattle in another. The latter are supplied with straw and a little meadow hay, and a few turnips when the crop is plentiful. The breeding cattle are somewhat more liberally treated, receiving a large proportion of hay of supeiror quality and more turnips. Other occupiers, chiefly on the more extensive holdings, prefer to allow the yearlings and 2-year-olds to roam at large in the fields, where they have a few turnips thrown out upon a piece of clean lea ground, with a rack of hay or straw in an open shed at night. With this fare and the rough grass which they pick up in the woods it is surprising how well they keep up their condition, a fact which at once stamps the hardy character of the race. At 3 years of age the heifers are selected for breeding purposes, as it has been found that they are not mature enough at a younger period of their existence. In the winter and spring months—that is to say, in January, February, March, and April—the calves are dropped. Here may be noticed another diversity of opinion which exists. Some farmers keep the calves separated from the dams until the periodical turning out to grass, allowing them to be together for a short period three times a day; others keep them in a fold together, and although the latter system has many advantages, yet both the dam and her young become very wild and almost unapproachable when allowed full liberty. In the beginning of October the calves are weaned, and as the temperature at that season

is generally low the cows seldom suffer from sore udder, the milk having become almost dried up on account of the failing pastures. It may here be remarked that some farmers of the present day give cake to the growing calves as well as to the cattle intended for the shambles. This insures bone and rapid growth in the one case and early maturity and a highly finished state in the other, but the plan can scarcely be called a judicious one in the case of calves which have afterwards to be turned upon the bleak moors and there to subsist upon the scanty fare which nature has provided for them.

Plate 19 shows a group of cattle at Ardtornish, where there is one of the best-known herds of the Highland breed. This place is situated in the Western Highlands of Scotland, in the county of Argyll, on the shore of the Sound of Mull; the latter being a strip of water separating the island of Mull from the mainland. Here we have an excellent example of Highland cattle under typically natural surroundings.

At Ardtornish the cattle, excepting the cows, live outdoors on the wild pasture grounds all the year round. The cows are taken indoors in November. The calves arrive toward the end of winter, so that the earliest of them are large enough to follow their dams when the grass season begins. Care is taken not to let the calves out in the open pasture too soon, as the cattle are accustomed to wander over great distances, and this would be apt to overtax the young animals. The late calves are put in a convenient inclosure into which their dams are given access twice a day to suckle them.

FAT STOCK, WEIGHTS, ETC.

In the consideration of any breed of the beef type for this country the commercial aspect of the case is necessarily all-important. The average American farmer must be convinced of the profitableness of handling any particular line of live stock, otherwise he can not be expected to take it up. In order to arrive at a true estimate of the Highland breed in this respect, a comparison must be made with other beef breeds. For this purpose certain facts and figures deduced from the latest Smithfield Fat Stock Show, held in London, England, in December, 1904, are given. This show, as is well known, is the recognized supreme test of fat stock in Great Britain.

A perusal of the table presented below will show that the Highland cattle are smaller framed and mature less early than the other breeds. It should be remembered, however, that they are here brought into competition with the flower of the British early-maturing breeds, whose lives prior to their appearance in the show ring have probably been cast in radically different lines from those of the northern breed.

It would be difficult, of course, for the Highlander to compete with the early maturing breeds under conditions favorable to the

latter, but, with the conditions reversed, it is likely that the verdict of the breeder would be in favor of the hardier animal. This, however, is a matter for the practical stockman to decide for himself.

In regard to the weight column of the table: While the more pampered breeds have a considerably higher average, the Highland classes have, nevertheless, attained a satisfactory commercial size. It has, in fact, been frequently demonstrated that large steers of the Highland breed can be grown, even exceeding 2,000 pounds, as the following weights of prize winners in the Highland purebred classes of 1904 prove: At the Birmingham show a yellow steer 1,245 days old, weighing 1,738 pounds, took first honors; at Edinburgh, a white ox 1,424 days old, weighing 2,112 pounds, and a yellow ox 1,429 days old, weighing 2,036 pounds, were among the winners; at Smithfield, in the younger division, a steer 979 days old, weighing 1,549 pounds, was first, while the second, 3 months older, topped the scale at 1,667 pounds; in the older division a steer 1,308 days old, weighing 1,837 pounds, was the winner. However, outside of extremes, quality is more important than size, and the strongest claims are made for the Highland breed in this respect. The question also arises, What sort of an animal do the butchers want? According to the Live Stock Journal's critic, the sentiment prevailing at the last Smithfield show was that mammoth carcasses were no longer in favor.

Regarding the matter of early maturing, an authority on the breed states that the Highlander matures later, not because of his incapacity for earlier development, but because he is not given the chance of early maturity. The prevailing custom is not to feed him up until he is about 2 years old, and it is contended that if feeding was undertaken at an earlier age he would, in time, make as good a showing as the other beef breeds.

The table gives the average records of the steer and heifer classes of several of the more important breeds at the Smithfield show, in separate form, showing the following details: (1) The number of entries in each class; (2) the average age of the class; (3) the average weight of the class, and (4) the average daily gain. The latter is computed by dividing the total age, in days, into the total weight, in pounds.

Averages of selected beef breeds at Smithfield Fat Stock Show, 1904.

[Compiled from the London, England, Live Stock Journal.]

Breed.	Number in exhibit.	Average age.	Average weight.	Average daily gain.
		Days.	*Pounds.*	*Pounds.*
Hereford—				
Steers	4	1,004	1,742	1.74
Heifers	4	956	1,586	1.66
Shorthorn—				
Steers	8	1,037	1,838	1.77
Heifers	4	985	1,727	1.75
Aberdeen-Angus—				
Steers	5	1,046	1,852	1.77
Heifers	4	1,055	1,673	1.59
Welsh—				
Steers	7	1,068	1,924	1.80
Heifers	5	1,054	1,575	1.50
Highland—				
Steers	6	1,019	1,470	1.44
Oxen	6	1,348	1,786	1.33
Heifers	5	1,334	1,485	1.11
Crossbred—				
Steers	6	1,015	1,823	1.80
Heifers	6	1,066	1,749	1.64

It will be noticed that the Highland classes make a strong numerical showing, in spite of the long distance of Smithfield from the native folds of the breed—a fact which speaks for their popularity. The table shows that the six Highland steers in the 3-year-old class averaged 1,470 pounds in weight. This average, however, would have been quite a little higher but for the presence of one small animal which weighed only 1,208 pounds—more than 200 pounds below any of the others. These steers made an average daily gain of practically $1\frac{1}{2}$ pounds, the small steer again bringing the average down several points. The critic of the London Live Stock Journal characterized this exhibit as "very fine."

The average daily gains of the Highland oxen and heifers are, on account of their greater age, somewhat lower than the others, but it may be mentioned that the largest of the oxen was an excellent feeder, having averaged a daily gain of 1.46 pounds for 1,421 days. This animal was the second largest in the entire Smithfield show; his weight was 2,074 pounds, and he was just under 4 years old.

It may be here mentioned that at the Scottish National Fat Stock Show of 1904, held at Edinburgh, the champion steer was a Highlander (Errol Candidate III), which triumphed over a numerous entry of Shorthorns, Aberdeen-Angus, Galloways, and crossbreds, but he in turn was defeated by a crossbred heifer for the premier honor of the show.

THE BLOCK TEST.

In comparing the relative merits of the beef breeds it is very necessary to procure data on this important feature. Slaughter tests have been annually conducted in connection with the London Smithfield show for the past ten years, the first one having been carried out in 1895. A detailed account of this first test may be found in the Twelfth and Thirteenth Annual Reports of this Bureau, on page 326. It will be seen that the first prize on this occasion was taken by a Highlander. It should be stated, however, that this initial success of the Highland breed has not been followed up in the succeeding carcass competitions, the best showing since then having been a "reserve" in 1897; but it must be said that in several of the competitions there were no representatives of the breed entered.

The statement next following shows some details relating to the carcasses of the Smithfield cattle at the latest show, held in December, 1904. These data are compiled from reports of butchers who had purchased the cattle at the show, the object here again being to compare the Highland with other breeds. Four reports were all that were received of Highland cattle. These are all enumerated separately, and the averages of all breeds placed alongside for comparison. The Dexters are not included in the "all-breeds" columns, as their diminutive size would militate against a true average.

It was to be expected that the Highland animals would show up considerably above the average as regards weight of hide, the heavy hide being the result of their characteristic hardiness. The percentage of dressed weight to live weight is a few points in favor of the other breeds, with the exception of the finely bred Highland heifer Princess Fausta (breed champion).

Slaughter test of cattle from Smithfield Club Show, 1904.

[Compiled from London, England, Live Stock Journal.]

Description of animal.	Age.	Live weight.	Weight of dressed carcass.	Percentage of carcass to gross live weight.	Weight of hide.	Weight of loose fat.
	Days.	*Pounds.*	*Pounds.*		*Pounds.*	*Pounds.*
Highland ox (Donnacha Odhar)	1,348	1,634	1,016	62.17	118	120
Highland steer (Sir John Swinburne's entry)	1,019	1,568	960	61.22	143	115
Average of all breeds (steers above 2 years old)	1,047	1,743	1,146	65.73	103	85
Highland heifer (Princess Fausta)	1,344	1,404	920	65.53		
Highland heifer (Madam Brandon)	1,299	1,521	958	62.98	104	121
Average of all breeds (heifers above 2 years old)	1,043	1,488	989	66.45	76	85

The butchers' remarks in regard to the Highland carcasses were:

The steer: "Cut full of flesh and very salable for a show beast."

Heifer Princess Fausta: "Very good beef, nicely mottled, but rather fat."

Heifer Madam Brandon: "Cut up full of flesh and very large in the kidneys."

PRICES OF PEDIGREE STOCK.

The information gathered under this head is intended to give prospective buyers or any others who may be interested an idea of the general run of the values of purebred Highland cattle. It should be understood, however, that the prices here noted were paid for the cattle at their native markets in Scotland; a considerable addition must be made to these figures to represent the cost of bringing them to this country. Probably about the lowest figure that could be reckoned on in this connection would be $20 to $25 per head.

Highland cattle do not command nearly as high prices as fancied specimens of the more fashionable beef breeds, such as Shorthorns, Aberdeen-Angus, or Herefords. The large sums frequently paid for representatives of the latter breeds are, in a large measure, due to the strong foreign demand for them. Argentine buyers have been especially active in the British markets of late years. The statement made in connection with the Perth Shorthorn sale of 1904 is typical of the extent of their operations. At the sale in question there was a brisk home demand for good commercial animals, but "anything over average quality at once brought out the Argentine buyers, to whom price seems no object." There being none of this fictitious character in connection with the Highland cattle sales, it is probable that a much better return on the investment can be secured with this breed than with the other breeds mentioned.

The prices brought at the three principal sales of purebred Highland cattle in 1904 are found below. The sales enumerated include the two annual official sales of the breed, namely, the spring bull sale and the fall cow and heifer sale, the third being the dispersal sale of one of the famous herds of the breed. Some particulars of the spring sale of 1905 are given also.

THE SPRING SALE, 1904.

This sale was held at Oban in February, 1904. There being a short entry on this occasion, the prices ranged higher than usual. This being an official sale, the animals in the several classes are judged, prizes being given to encourage the breeders to put forth their best efforts. There were more than three prizes in each class, but it is considered sufficient to give particulars of the first three only in each case, together with the averages of the entire sale.

Aged bulls:

(1) Victor XXII (1600), black, sold for	£53=$258
(2) Schiehallion II (1740), red, sold for	61= 297
(3) Donnacha Coir (1806), sold for	32= 156

Two-year-old bulls:

(1) Malachi (1870), sold for	61= 297
(2) Kildare, light dun, sold for	52= 253
(3) Fear-a-Ghlinne-So, sold for	44= 214

Yearling bulls:

(1) Waverly of Dunlossit, yellow, sold for	£40=$195
(2) Lord Clyde, brindled, sold for	51= 248
(3) Domhnull Mollach III, sold for	36= 175

The first in the two-year-old class—Malachi—was also awarded the medal for the best specimen of the breed in the sale, but the best animal from the buyers' point of view was the 2-year-old bull Royalist (1890), which was only placed fifth in his class because of being shown out of his hair. Royalist brought the top price of the day—£84 ($409).

The complete figures and averages for the sale were as follows:

14 aged bulls averaged	£32=$156
24 two-year-old bulls averaged	34= 165
11 bull stirks (yearlings) averaged	26= 127

The averages for the previous year were considerably lower. They were:

Older bulls	£29=$141
Two-year-olds	31= 151
Stirks	18= 88

There was no demand for cows at this sale, only 1 out of 9 being sold for £10½ ($50). Four 2-year-old heifers were sold at a shade over £8½ ($41) each.

THE MELFORT SALE.

One of the most interesting events of recent years in Highland cattle circles was the dispersion of the well-known Melfort fold, which took place in May, 1904. The two highest prices obtained at this sale were £45 ($219) for Molog VIII, a brindled 2-year-old heifer, and £41 ($200) for Esther, a yellow 6-year-old cow. The summary of the sale is as follows:

30 cows averaged	£18⅓=$89
13 three-year-old heifers averaged	19¾= 96
14 two-year-old heifers averaged	16 = 78
11 yearling heifers averaged	13 = 63
9 yearling steers averaged	11¼= 55
3 stock bulls averaged	26⅓=128

FALL PEDIGREE SALE OF COWS AND HEIFERS.

The latest annual fall sale of the cattle society was held at Oban, in October, 1904. Large numbers of cows and heifers are annually offered at this sale, but the report from which our figures are obtained does not give detailed averages. The top price of the sale was £51 ($248), brought by the brindled Dunlossit cow Cattadale (5766). As regards the averages, judging from the prices obtained for a number of the lots, they will probably work out somewhat lower than the Melfort figures in the preceding paragraph.

THE SPRING SALE OF 1905.

A brief summary of the spring sale of 1905 is as follows:

Championship honors on this occasion were captured by a yearling bull, Coruisk, bred by John MacDonald, Duntulm, Skye. He is a red, finely matured, and wonderfully haired, and is well endowed with the typical points of a good Highland bull, having great strength of bone, grand back, long quarters, and fine head. Coruisk was sold for £60 ($292). The first-prize aged bull at this sale, Ben Laoghal, a brindled 4-year-old bred by the Duke of Sutherland, changed hands at £59 ($287). The second-prize aged bull sold for £36 ($175), and the third, which was the sire of the above-mentioned champion yearling, made £46 ($224).

The first-prize 2-year-old bull at this sale was less fancied by buyers than the other prize winners in his class. He was sold at £40 ($195). The second in this class, Domhnull Riabhach of Airthrey, would have brought the highest price of the sale, but he was withdrawn at £62 ($302), after a keen competition. The third-prize 2-year-old bull, a dark brindle of great substance, made £56 ($273).

The yearling bulls at this sale were above the average. The first prize and champion—Coruisk—has already been described. Second prize was taken by the yellow bull The Gael of Dunlossit, which sold for £27 ($131). The third was more fancied, and brought £34 ($165).

The averages for the entire sale were:

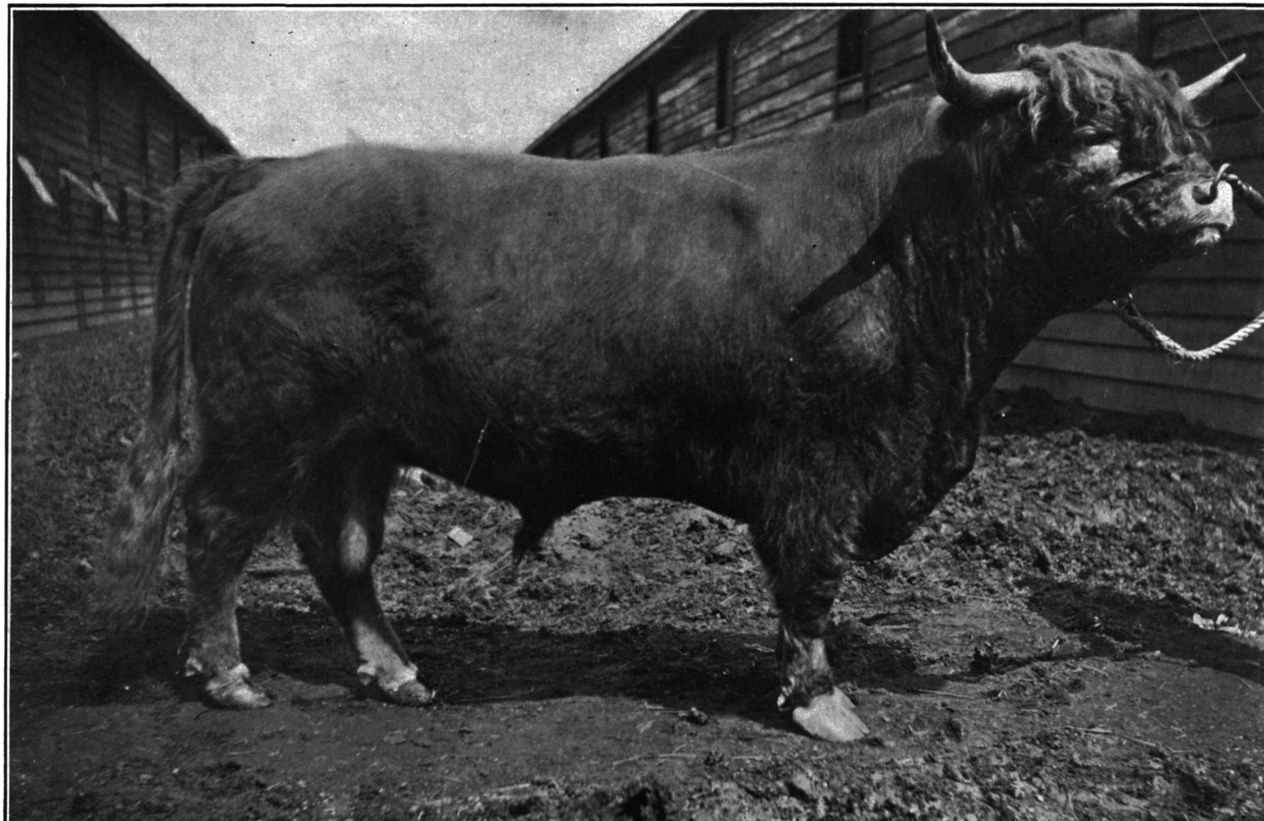
19 aged bulls	£24½	=	$119
25 two-year-old bulls	32¼	=	157
24 yearling bulls	21	=	102

HIGHLAND CATTLE IN AMERICA.

It has previously been intimated that there are not many representatives of this breed in the United States. So far as we know there are only two or three herds in the country. One is in Nevada and is owned by Governor Sparks; another is in the State of New York, where Mr. Van Norden has a good-sized herd which he imported a few years ago, a number of which were exhibited at the St. Louis Exposition. There are some Highland cattle at Mountain Lawn,

Group of Highland Cattle at Ardtornish, Highlands of Scotland, Showing Natural Surroundings.

An. Rpt. B. A. I. 1904.



Highland Bull Sir Andrew.

Champion at Louisiana Purchase Exposition, 1904.

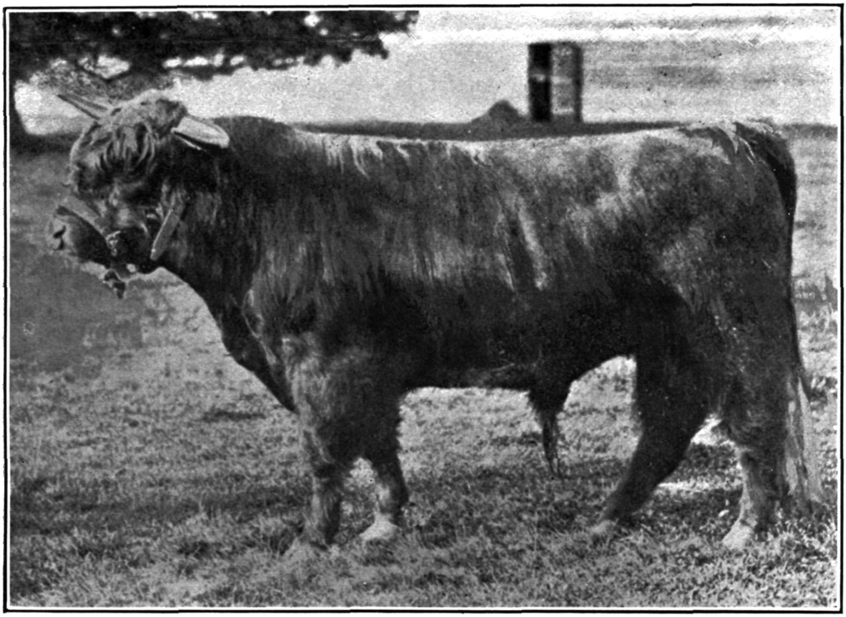


Fig. 1.—Highland Bull Calum Riabhach II of Atholl (1325).

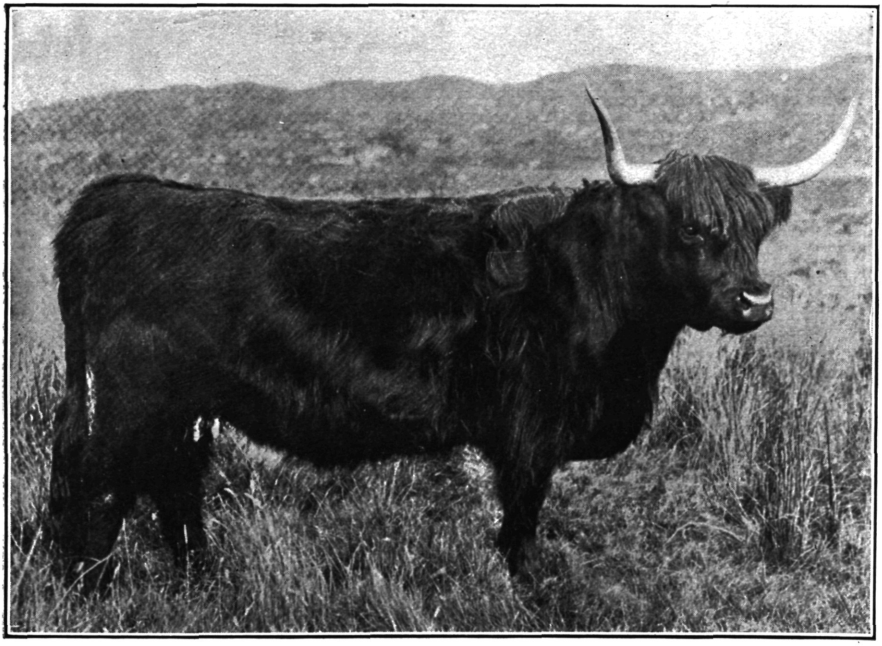


Fig. 2.—Typical Highland Cow.

GROUP OF HIGHLAND CATTLE IN NEW YORK.

Photograph furnished by W. M. Van Norden, Rye, N. Y.

Bristol, N. H., also, and the Colorado Agricultural College owns one cow.

The Highland Cattle Society of Scotland[a] has been conducting correspondence, with a view to encouraging the exportation of the cattle to Canada and the Northwest Territory as well as to other parts of the world.

Mr. D. Mitchel, of Putaendo, Chilean Andes, has introduced Highland cattle (two bulls and several in-calf heifers arrived safely) to improve the horned cattle on his estate. Another exportation to this region is referred to in the Scottish Farmer of March 18, 1905. A picture is shown of the bull Fheambar, who with 9 females were about to be shipped to Patagonia, near the southern end of South America.

THE ILLUSTRATIONS.

Plate 16—Group of Highland cattle.—These are a part of the herd, previously mentioned, at Ardtornish, Scotland. The cattle are pictured as they stood on their native soil amid their natural surroundings of rough heath, mountain, rock, and water. The projecting outline in the left background of the picture is the ruin of an ancient castle on the shore of the Sound of Mull. In olden times this was the residence of the lord of the isles. This picture is reproduced by courtesy of Country Life (England).

Plate 17, fig. 1—Calum Riabhach II of Atholl (1325).—This stylish bull, bred and owned by the Duke of Atholl, was, when in his prime, rated as one of the handsomest and best-haired specimens of the breed seen for a generation. He is a representative of the old Dubh Chiar family. He was breed champion at the Highland Cattle Society's shows of 1898 and 1899, and his son, King Alaric (1712), was the breed champion at the shows of 1903 and 1904. He also sired the heifer Princess Fausta, who is elsewhere referred to as champion of the breed at the Smithfield Fat Stock show of 1904.

Plate 17, fig. 2—Typical Highland cow.—This excellent representative of the female sex is a member of the famous herd at Ardtornish, Argyllshire Highlands, Scotland. A cow from this herd carried off the premier honors of the breed (over all entries, cows and bulls) at the Highland Cattle Society's show in 1902.

Plate 18—Sir Andrew.—Highland bull imported and owned by W. M. Van Norden, Rye, N. Y. Sir Andrew was champion of the Highland exhibit at the St. Louis World's Fair live-stock show, 1904.

Plate 19.—Highland cattle in New York State.—A group of cows on Mr. Van Norden's place at Rye, N. Y.

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[a] The offices of the society are at Inverness, Scotland.

ALFALFA FOR THE GROWING AND FATTENING OF ANIMALS IN THE GREAT PLAINS REGION.

By I. D. GRAHAM, A. M.,
Topeka, Kans.

PRELIMINARY REMARKS.

Alfalfa is the most valuable and most important plant known to Western agriculture. No other agricultural product has grown so rapidly in public esteem in the last ten or fifteen years as has this one. This statement is intended to apply more especially to the vast region lying to the south and west of the Missouri River, as it has not yet been demonstrated that alfalfa and its related plant, red clover, are equally adaptable to the same conditions of soil and climate. The alfalfa plant seems especially adapted to the high plains of what once was known as the semiarid region, because of its ability to resist drouth and because of its enormous root growth, which penetrates the subsoil to regions of perpetual moisture. It has long been known to the primitive agriculturists of the western portion of the territory included in the Louisiana purchase, but its adaptability and value as an agricultural product have been appreciated in the region lying between the Mississippi River and the Rocky Mountains only in recent years. A good illustration of its growth in public favor is shown by the statistical reports of the Kansas Board of Agriculture, which state that in 1891 Kansas had 34,384 acres, while in 1904 she had a total of 557,509 acres in growing alfalfa.

This large and new horizon of the alfalfa plant has revolutionized the animal husbandry of this great region and has opened up a very large area that was heretofore considered useless, or nearly so, for the production, not only of a living for the stock-growing farmer and his family, but of an absolutely certain means of obtaining wealth as well. Its capability of growing and producing a profitable crop under adverse climatic conditions, the certainty with which it develops, and its value when produced have served to remove the element of uncertainty which so long hindered the development of profitable agriculture in the Great Plains region.

In bringing together facts about the alfalfa plant the writer has drawn liberally upon the experimental work performed by the differ-

ent experiment stations, not because this is the only source of information, but rather because these results are published in accurate and scientific form, though they represent what is common to the practice of feeders and farmers throughout the alfalfa region.

One peculiarity of the alfalfa plant lies in its habit of sending roots down deep into the earth. After it is once well established it becomes a perennial that is practically independent of climatic conditions. The writer has a personal knowledge of a field of alfalfa in Kansas that was well established in 1878, when he first saw it, and that has been in alfalfa ever since, with no reseeding and no care other than to mow the crops and disk the surface of the ground occasionally.

One of the most valuable characteristics of this plant, however, is its ability, in common with other legumes, to gather nitrogen from the atmosphere, with the result that the plant itself becomes a highly nitrogenous food for domestic animals, and its growth serves to enrich the land instead of impoverishing it.

ITS COMPONENT PARTS CONSIDERED.

In the development of young animals, the supplying of muscle for the work horse, and in the producing of milk, it is found that protein is the important element. Carbohydrates may be substituted for fats, or vice versa, within reasonable limits, and without detriment to the animal, and protein may to some extent be substituted for either; but neither carbohydrates nor fats can be substituted for protein. Protein is an essential element in the food of both man and beast. It is the element producing muscle and tendon, and hence is necessary to the proper growth and development of all young animals, and is most easily supplied to them through rich nitrogenous foods. The alfalfa plant has been found to be so rich in protein that it ranks high above all other feeds that are used for roughage and stands well up among the more concentrated feeds. It has been found by experiment that 100 pounds of alfalfa contain 3.3 pounds more of total digestible nutrients than does wheat bran and almost as much protein. It is richer in digestible protein than wheat, corn, oats, rye, barley, Kafir-corn seed, or sorghum seed. Its nutritive ratio is so narrow that it is equaled only by wheat bran, linseed meal, cotton-seed meal, and soy beans. Alfalfa is an ideal feed for the development of young stock in muscle and general growth and for the milch cow. It is especially valuable, in combination with corn, as a ration for fattening steers, since it furnishes all the roughage necessary and is a very cheap source of protein. For the sake of comparison, the following table, showing percentage composition of some of the commoner feedstuffs, is given:

Composition of some common feedstuffs.

Feedstuff.	Protein (containing nitrogen).	Nitrogen-free extract (carbohydrate)	Ether extract (fat).
Soy beans	34.0	28.8	16.9
Dent corn	10.3	70.4	5.0
Linseed meal	33.2	38.4	4.0
Red clover (fresh)	4.4	13.5	1.5
Timothy (fresh)	3.1	20.2	1.2
Red clover (hay)	12.3	38.1	3.3
Alfalfa hay	14.3	42.7	2.2
Timothy hay	6.0	41.9	3.0

Digestion experiments made at the Kansas Experiment Station show that air-dry alfalfa hay contains 10.43 per cent of protein, 0.69 per cent of fat, 28.18 per cent of carbohydrates, and 15.99 per cent of crude fiber; the total digestible nutrients being 55.29 per cent. For the sake of further comparison it may be stated that the percentage of total digestible nutrients of other common feeds used for roughage is as follows: Millet 57.6, oat hay 52.2, orchard-grass hay 48.2, timothy hay 48, prairie hay 46.7, sorghum hay 44.2, red-clover hay 43.9, corn fodder 35.8. It will be noted that only one of these feeds equals alfalfa in total digestible nutrients. But in making this comparison it must be remembered that it costs much more to produce feeds rich in protein than it does to produce those rich in carbohydrates, and consequently, of two feeds containing an equal amount of digestible nutrients the one containing the more protein is the more valuable. When alfalfa is compared with the other feeds just named, it is found to rank far ahead of the richest of them. One hundred pounds of alfalfa hay contains 11.3 pounds more digestible matter than the same amount of red-clover hay and one and one-half times as much protein. It contains 2.3 pounds less of total digestible nutrients than the same amount of millet hay and almost two and one-half times as much digestible protein. It contains two and one-half times as much digestible protein as oat hay, three times as much as prairie hay, more than four times as much as sorghum hay, five times as much as corn fodder, and thirteen times as much as wheat straw.

It will thus be seen that alfalfa furnishes a feed which is almost a perfect ration for the growing animal and the milch cow, and that, in order to fatten an animal, it is only necessary to add some other feed that is rich in fats and carbohydrates to make an ideal combination.

Some time since, Mr. E. B. Cowgill, editor of the Kansas Farmer, at Topeka, did some very valuable work in determining the value of

Cutting Alfalfa on the Hesper Farm, Billings, Mont.

Photograph furnished by N. D. Smith.

a number of the commoner feeds. From his investigations, based upon the market price of these, we learn that protein costs about $3.37 per 100 pounds, carbohydrates $0.32 per 100 pounds, and fats $0.56 per 100 pounds. Applying these values to the nutritive constituents of feeding stuffs, as given in standard tables, a useful table has been compiled by simple arithmetical methods, from which we quote as follows:

Relative money values of feedstuffs.

Feedstuff.	Dry matter in 100 pounds.	Digestible nutrients in 100 pounds of feeding stuffs.[a]						Total value of digestible nutrients in 100 pounds.
		Protein.		Carbohydrates.		Fats.		
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
Concentrates.	*Pounds.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Cents.*
Corn, dent	89.4	7.8	26.3	66.7	21.3	4.3	2.4	50.0
Corn, flint	88.7	8.0	27.0	66.2	22.0	4.3	2.4	50.14
Corn-and-cob meal	84.9	4.4	14.8	60.0	19.2	2.9	1.6	35.6
Gluten meal	91.8	25.8	86.9	43.3	13.9	11.0	6.2	107.0
Germ meal	89.6	9.0	30.3	61.2	19.6	6.2	3.5	53.4
Glucose meal	91.9	30.3	102.1	35.3	11.3	14.5	8.1	121.5
Wheat	89.5	10.2	34.4	69.2	22.1	1.7	1.0	57.5
Wheat bran (spring wheat)	88.5	12.9	43.5	40.1	12.8	3.4	1.9	58.2
Wheat bran (winter wheat)	87.7	12.3	41.5	37.1	11.8	2.6	1.5	54.8
Wheat shorts	88.2	12.2	41.1	50.0	16.0	3.8	2.1	59.2
Wheat middlings	87.9	12.8	43.1	53.0	17.0	3.4	1.9	62.0
Wheat screenings	88.4	9.8	33.0	51.0	16.3	2.2	1.2	50.5
Rye	88.4	9.9	33.4	67.6	21.6	1.1	.6	55.6
Barley	89.1	8.7	29.3	65.6	21.0	1.6	.9	51.2
Malt sprouts	89.8	18.6	62.7	37.1	11.9	1.7	1.1	75.7
Brewers' grains (wet)	24.3	3.9	13.1	9.3	3.0	1.4	.8	16.9
Brewers' grains (dry)	91.8	15.7	52.9	36.3	11.6	5.1	2.9	67.4
Oats	89.0	9.2	31.0	47.3	15.1	4.2	2.4	48.5
Oatmeal	92.1	11.5	38.8	52.1	16.7	5.9	3.3	58.8
Oat feed or shorts	92.3	12.5	41.1	46.9	15.0	2.8	1.6	57.7
Rice	87.6	4.8	16.2	72.2	23.1	.3	.2	39.5
Rice hulls	91.8	1.6	5.4	44.5	14.2	.6	.3	19.9
Rice bran	90.3	5.3	17.9	45.1	14.4	7.3	4.1	36.4
Sorghum seed	87.2	7.0	23.6	52.1	16.7	3.1	1.7	42.0
Broom-corn seed	85.9	7.4	25.9	48.3	15.5	2.9	1.6	43.0
Kafir corn	84.8	7.8	26.3	57.1	18.3	2.7	1.5	46.1
Millet	86.0	8.9	30.0	45.0	14.4	3.2	1.8	46.1
Flaxseed	90.8	20.6	69.4	17.1	5.5	29.0	16.2	91.1
Linseed meal (old process)	90.8	29.3	98.7	32.7	10.5	7.0	3.9	113.1
Linseed meal (new process)	89.9	28.2	95.0	40.1	12.8	2.8	1.6	109.4
Cotton seed	89.7	12.5	42.1	30.0	9.6	17.3	9.7	61.4
Cotton-seed meal	91.8	37.2	125.4	16.9	5.4	12.2	6.8	137.6
Cotton-seed hulls	88.9	.3	1.0	33.1	10.6	1.7	1.0	12.6
Sunflower seed	92.5	12.1	40.8	20.8	6.5	29.0	16.2	63.5
Sunflower-seed cakes	91.8	31.2	105.1	19.6	6.3	12.8	7.2	118.6
Peanut meal	89.3	42.9	144.6	22.8	8.6	6.9	3.9	157.1
Pease	89.5	16.8	56.6	51.8	16.6	.7	.4	73.6
Soy beans	89.2	29.6	99.8	22.3	7.1	14.4	8.1	115.0

[a] Values of protein at 3.37 cents per pound, carbohydrates at 0.32 cent per pound, and fats at 0.56 cent per pound.

Relative money values of feedstuffs—Continued.

Feedstuff.	Dry matter in 100 pounds.	Digestible nutrients in 100 pounds of feeding stuffs.						Total value of digestible nutrients in 100 pounds.
		Protein.		Carbohydrates.		Fats.		
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
Concentrates—Continued.	*Pounds.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Cents.*
Cowpeas	85.2	18.3	61.7	54.2	17.3	1.1	0.6	79.6
Horse beans	85.7	22.4	75.5	49.3	15.8	1.2	.7	92.0
Roughage.								
Fodder corn (green)	20.7	1.0	3.4	11.6	3.7	.4	.2	7.3
Fodder corn (field cured)	57.8	2.5	8.4	34.6	11.1	1.2	.7	20.2
Corn stover (field cured)	59.5	1.7	5.7	32.4	10.4	.7	.4	16.5
Fresh grass.								
Pasture grasses (mixed)	20.0	2.5	8.4	10.2	3.3	.5	.3	12.0
Kentucky blue grass	34.9	3.0	10.1	19.8	6.3	.8	.4	16.8
Timothy (different stages)	38.4	1.2	4.0	19.1	6.1	.6	.3	10.4
Orchard grass in bloom	27.0	1.5	5.1	11.4	3.6	.5	.3	9.0
Redtop in bloom	34.7	2.1	7.1	21.2	6.8	.6	.3	14.2
Sorghum	20.6	.6	2.0	12.2	3.9	.4	.2	6.1
Meadow fescue in bloom	30.1	1.5	5.1	16.8	5.4	.4	.2	10.7
Hungarian grass	28.9	2.0	6.7	16.0	5.1	.4	.2	12.0
Peas and oats	16.0	1.8	6.1	7.1	2.3	.2	.1	8.5
Peas and barley	16.0	1.7	5.7	7.2	2.3	.2	.1	8.1
Hay.								
Timothy	86.8	2.8	9.8	43.4	13.9	1.4	.8	24.1
Orchard grass	90.1	4.9	16.5	42.3	13.5	1.4	.8	30.8
Redtop	91.1	4.8	16.2	46.9	15.0	1.0	.6	31.8
Kentucky blue grass	78.8	4.8	16.2	37.3	11.9	2.0	1.1	29.2
Hungarian grass	92.3	4.5	15.2	57.7	16.5	1.3	.7	32.4
Meadow fescue	80.0	4.2	14.2	43.3	13.9	1.7	1.0	29.1
Soy bean	88.7	10.8	36.4	38.7	12.4	1.5	.8	49.6
Oat	91.1	4.3	14.5	46.4	14.8	1.5	.8	30.1
Blue stem	92.2	3.4	11.5	29.6	9.5	1.4	.8	21.8
Straw.								
Wheat	90.4	.4	1.3	36.3	11.6	.4	.2	13.1
Rye	92.9	.6	2.0	40.6	13.0	.4	.2	15.2
Oat	90.8	1.2	4.0	38.6	12.4	.8	.4	16.8
Barley	85.8	.7	2.4	41.2	13.2	.6	.3	15.9
Wheat chaff	85.7	.3	1.0	23.3	7.5	.5	.3	8.8
Oat chaff	85.7	1.5	5.1	33.0	10.6	.7	.4	16.1
Fresh legumes.								
Red clover (different stages)	29.2	2.9	9.8	14.8	4.7	.7	.4	14.9
Alsike (bloom)	25.2	2.7	9.1	13.1	4.2	.6	.3	13.6
Crimson clover	19.1	2.4	8.1	9.1	2.9	.5	.3	11.3
Alfalfa	28.2	3.9	13.1	12.7	4.1	.5	.3	17.5
Bokhara (sweet clover)	12.5	1.6	5.4	2.3	.7	.2	.1	6.2
Cowpeas	16.4	1.8	6.1	8.7	2.8	.2	.1	9.0
Soy bean	24.9	3.2	10.8	11.0	3.5	.5	.3	14.6
Legume hay and straw.								
Red clover (medium)	84.7	6.8	22.9	35.8	11.5	1.7	1.0	35.4
Red clover (mammoth)	78.8	5.7	19.2	32.0	10.2	1.9	1.1	30.5
Alsike clover	90.3	8.4	28.3	42.5	13.6	1.5	.9	42.8
White clover	90.3	11.5	38.8	42.2	13.5	1.5	.9	53.2

Relative money values of feedstuffs—Continued.

Feedstuff.	Dry matter in 100 pounds.	Digestible nutrients in 100 pounds of feeding stuffs.						Total value of digestible nutrients in 100 pounds.
		Protein.		Carbohydrates.		Fats.		
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	
Legume hay and straw—Con.	*Pounds.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Pounds.*	*Cents.*	*Cents.*
Crimson clover	90.4	10.5	35.4	34.9	11.2	1.2	0.7	47.3
Alfalfa	91.6	11.0	37.1	39.6	12.7	1.2	.7	50.5
Bokhara (sweet clover)	85.7	8.5	28.6	18.1	5.8	1.6	.9	35.3
Cowpea hay	89.3	.8	36.4	38.6	12.4	1.1	.6	49.4
Soy-bean straw	89.9	2.3	7.8	40.0	12.8	1.0	.6	21.2
Pea vine	86.4	4.3	14.5	32.3	10.3	.8	.4	25.2
Silage.								
Corn	20.9	.9	3.0	11.3	3.6	.7	.4	7.0
Clover	28.0	2.0	6.7	13.5	4.3	1.0	.6	11.6
Sorghum	23.9	.6	2.0	14.9	4.9	.2	.1	7.0
Alfalfa	27.5	3.0	10.1	8.5	2.7	1.9	1.1	13.9
Grass	32.0	1.9	6.4	13.4	4.3	1.6	.9	11.6
Cowpea vine	20.7	1.5	5.1	8.6	2.8	.9	.5	8.4
Roots and tubers.								
Beet (common)	13.0	1.2	4.0	8.8	2.8	.1	.1	6.9
Beet (sugar)	13.5	1.1	3.7	10.2	3.3	.1	.1	7.1
Beet (mangel)	9.1	1.1	3.7	5.4	1.7	.1	.1	5.5
Flat turnip	9.5	1.0	3.4	7.2	2.3	.2	.1	5.8
Rutabaga	11.4	1.0	3.4	8.1	2.6	.2	.1	6.1
Carrot	11.4	.8	2.7	7.8	2.5	.2	.1	5.3
Parsnip	11.7	1.6	5.4	11.2	3.6	.2	.1	9.1
Artichoke	20.0	2.0	6.7	16.8	5.4	.2	.1	12.2
Miscellaneous.								
Cabbage	15.3	1.8	6.1	8.2	2.6	.4	.2	8.9
Sugar-beet leaves	12.0	1.7	5.7	4.6	1.5	.2	.1	7.3
Pumpkin (field)	9.1	1.0	3.4	5.8	1.9	.3	.2	5.5
Pumpkin (garden)	19.2	1.4	4.7	8.3	2.6	.8	.4	7.7
Rape	14.0	1.5	5.1	8.1	2.6	.2	.1	7.8
Dried blood	91.5	52.3	176.3	.0	.0	2.5	1.4	177.7
Beet pulp	10.2	.6	2.0	7.3	2.3			4.3
Beet molasses	79.2	9.1	30.7	59.3	19.0	.0		49.7
Cows' milk	12.8	3.6	12.1	4.9	1.6	3.7	2.1	15.8
Cows' milk (colostrum)	25.4	17.6	69.3	2.7	.9	3.6	2.0	72.2
Skim milk (gravity)	9.6	3.1	10.4	4.7	1.5	.8	.5	12.4
Skim milk (centrifugal)	9.4	2.9	9.8	5.2	1.7	.3	.2	11.7
Buttermilk	9.9	3.9	13.1	4.0	1.3	1.1	.6	15.0
Whey	6.6	.8	2.7	4.7	1.5	.3	.2	4.4

The profitable adjustment of rations to the needs of domestic animals is a problem worthy of the farmer's most careful attention. The following table of feeding standards will be found useful in connection with the foregoing table of nutritive constituents and values:

Feeding standards for farm animals per day per 1,000 pounds live weight.

[Wolff-Lehmann.]

Animal.	Dry matter.	Digestible nutrients.			Nutritive ratio, 1 to—
		Protein.	Carbohydrates.	Fats.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	
Fattening cattle:					
First period	30	2.5	15.0	0.5	6.5
Second period	30	3.0	14.5	.7	5.4
Third period	26	2.7	15.0	.7	6.2
Milch cows, when yielding daily—					
11 pounds of milk	25	1.6	10.0	.3	6.7
16.6 pounds of milk	27	2.0	11.0	.4	6.0
22 pounds of milk	29	2.5	13.0	.5	5.7
27.5 pounds of milk	32	3.3	13.0	.8	4.5
Sheep:					
Coarse wool	20	1.2	10.5	.2	9.1
Fine wool	23	1.5	12.0	.3	8.5
Breeding ewes, with lambs	25	2.9	15.0	.5	5.6
Fattening sheep:					
First period	30	3.0	15.0	.5	5.4
Second period	28	3.5	14.5	.6	4.5
Horses:					
Light work	20	1.5	9.5	.4	7.0
Medium work	24	2.0	11.0	.6	6.2
Heavy work	26	2.5	13.3	.8	6.0
Brood sows	22	2.5	15.5	.4	6.6
Fattening swine:					
First period	36	4.5	25.0	.7	5.9
Second period	32	4.0	24.0	.5	6.3
Third period	25	2.7	18.0	.4	7.0

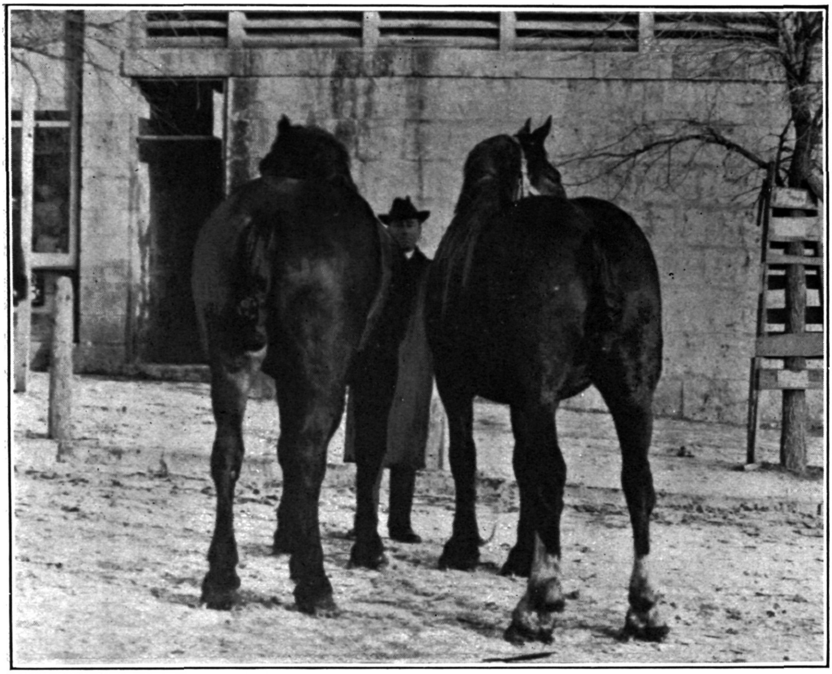
Feeding standards for growing animals.

Kind of animal and age in months.	Average live weight per head.	Dry matter.	Protein.	Carbohydrates.	Fats.	Nutritive ratio, 1 to—
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Growing cattle, dairy breeds:						
2 to 3	150	23	4.0	13.0	2.0	4.5
3 to 6	300	24	3.0	12.8	1.0	5.1
6 to 12	500	27	2.0	12.5	.5	6.8
12 to 18	700	26	1.8	12.5	.4	7.5
Growing cattle, beef breeds:						
2 to 3	160	23	4.2	13.0	2.0	4.2
3 to 6	330	24	3.5	12.8	1.5	4.7
6 to 12	550	25	2.5	13.2	.7	6.0
12 to 18	750	24	2.0	12.5	.5	6.8
Growing sheep, mutton breeds:						
4 to 6	60	26	4.4	15.5	.9	4.0
6 to 8	80	26	3.5	15.0	.7	4.8
8 to 11	100	24	3.0	14.3	.5	5.2
11 to 15	120	23	2.2	12.6	.5	6.3
Growing hogs, breeding stock:						
2 to 3	50	44	7.6	28.0	1.0	4.0
3 to 5	100	35	5.0	23.1	.8	5.0
5 to 6	120	32	3.7	21.3	.4	6.0
6 to 8	200	28	2.8	18.7	.3	7.0

Jubilee 33111. Mina 31721. Lena 40417. Fairy 40467. Ada 40465.

FIRST-PRIZE YOUNG PERCHERON STUD AT THE LOUISIANA PURCHASE EXPOSITION.

Lena and Mina were champion mares any age. Lena was junior champion and reserve grand champion, also Percheron special and gold medal. Fairy and Ada won first and second in class. All raised and fitted on alfalfa.



Teddy. Prince Henry.

FIG. 1.—A PAIR OF HALF-BREED PERCHERON GELDINGS.

These geldings were 3 and 4 years of age, respectively, full brothers, weighing 3,600 pounds, and sold for $500 at the barn door. Up to the time they were sold they had never tasted any other brand of hay than Kansas alfalfa.

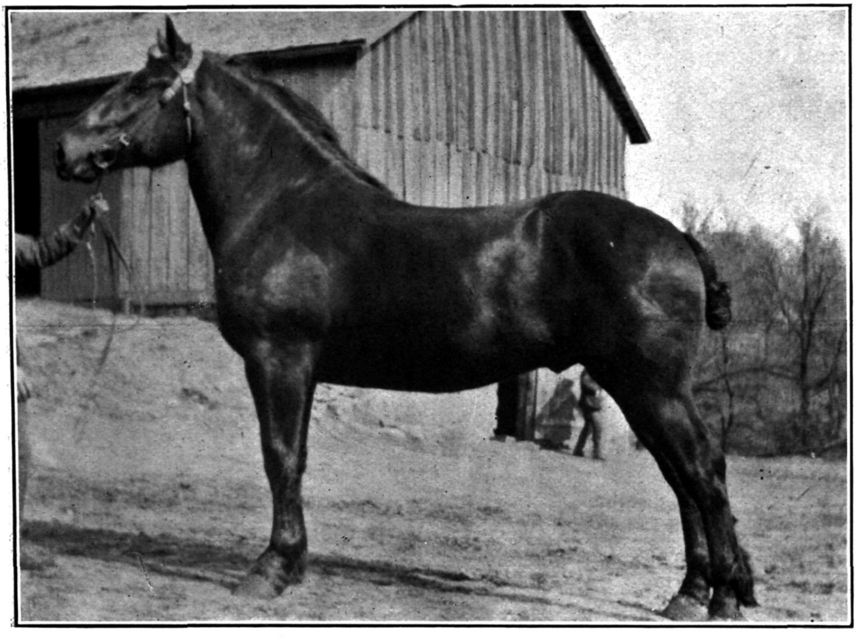


FIG. 2.—TWO-YEAR-OLD PERCHERON STALLION TAPAGEUR 35340.

He was winner of the seventh prize at the Louisiana Purchase Exposition. Raised on alfalfa and made a gain of 5 pounds per day for thirty days while being fitted.

To illustrate the use of these tables, let a ration be computed for a 1,000-pound dairy cow giving 22 pounds of milk per day. Suppose we have on the farm dent corn and timothy hay. This cow will, according to the table of feeding standards, require 29 pounds of dry matter a day (by dry matter is meant ordinary dry corn and hay). She must, then, have for a daily ration 2.5 pounds of protein, 13 pounds of carbohydrates, and 0.5 pound of fats. As the only way thus far for the determination of a properly balanced ration is the "cut and try" method, we will guess that the cow should have 10 pounds of corn chop and 19 pounds of hay per day. This would give her a ration, according to the table of feedstuffs, as follows:

Feedstuff.	Proteins.	Carbo-hydrates.	Fats.	Value.
	Per cent.	*Per cent.*	*Per cent.*	*Cents.*
Corn chop, 10 pounds	0.8	6.7	0.4	5
Timothy hay, 19 pounds	.5	8.2	.3	5
Total	1.3	14.9	.7	10
Standard requirements	2.5	13.0	.5	15¼

This ration has too much digestible carbohydrates and fats and only about half enough protein. In other words, it is a ration for fattening animals rather than for milk production, and the cow will probably lay on weight and decrease in her milk flow. If the animal weighs 1,000 pounds, it will require more than 1 pound of protein per day to sustain her, even though she give no milk. If we deduct this from the amount shown by the proposed ration, we have but 0.3 pound of protein for the milk production. As 22 pounds of average milk contains 0.8 pound of protein, it will be seen that the proposed ration is inadequate. It will also be noticed that it has less value than the standard ration would be worth at ordinary prices for feeding stuffs. How shall this ration be changed to give it the required amount of protein at reasonable cost? The answer is this: By substituting alfalfa hay for timothy. When this is done we have a value shown in the following table, in which the alfalfa is rated at $10 per ton, which is rather above the average in the region under consideration:

Feedstuff.	Proteins.	Carbo-hydrates.	Fats.	Value.
	Pounds.	*Pounds.*	*Pounds.*	*Cents.*
Corn chop, 10 pounds	0.8	6.7	0.4	5
Alfalfa hay, 19 pounds	2.1	7.5	.2	9½
Total	2.9	14.2	.6	14½
Standard requirements	2.5	13.0	.5	15¼

Nearly every farmer would be glad to realize $5 per ton per year for alfalfa; if this value is placed upon it the cost of the ration will be reduced to 9¾ cents, which more nearly represents the actual feeding conditions in this region. A glance at the table shows that the ration is richer in all of its constituents than is necessary for the supposed case. This is reduced by substituting cane, Kafir corn, or timothy hay for a portion of the alfalfa. Should the animal be unable to digest so much hay, she may be given some concentrated nitrogenous feed, like soy-bean meal, linseed meal, or glucose meal for a portion of the alfalfa. The examples given here are simply intended for illustration and not for model rations. The feeder will determine what problem he has on hand—whether it is that of the development of a young animal or the production of beef, milk, or muscle—and will then make his rations from the material at hand, with the aid of the values shown in the table.

VALUE OF THE HAY AT DIFFERENT PERIODS OF GROWTH.

Another important point to be considered in connection with the feeding value of alfalfa is the quality to be obtained through the harvesting and care of the plant. Experiments made at the Kansas Experiment Station in regard to the value in protein of alfalfa, cut at different periods of its growth, show the following results:

	Per cent.
One-tenth in bloom	18.5
One-half in bloom	17.2
In full bloom	14.4

It was also found here that the late cutting of the first crop seemed to injure the plant more than cutting at any other time; indeed, it was found more profitable to make the first cutting of alfalfa as soon as the field was one-tenth in bloom, even though the weather conditions prohibited the saving of the crop without spoiling. The increased yield from succeeding cuttings over that which was cut late much more than makes up for the loss of the first crop. Farmers who have been successful clover growers often spoil their first stand of alfalfa because they wait to cut it at the stage when red clover is usually cut.

In Utah the experiment station cut alfalfa at different stages of maturity, and fed the crop in the experiment of producing beef, which covered a period of five years, to determine the best time for cutting alfalfa for this purpose. The average production per year per acre was as follows:

	Hay.	Beef.
	Tons.	*Pounds.*
In first bloom	3.35	706
In full bloom	4.90	562
Half the blooms fallen	4.55	490

In addition to the facts stated in the above tables in favor of the early harvesting of alfalfa, it should be noted that soon after the alfalfa plant begins to blossom a number of the leaves turn yellow and fall to the ground. As the leaves are more valuable as feed because of their higher percentage of protein and lower proportion of crude fiber, it is of interest to know the necessity for early harvesting in order that a greater proportion of leaves may be saved in the hay. Experiment shows that the greatest proportion of leaves is found just before the blossoming period, but that the plant is so immature at this time that its greatest value for feed is not reached until it is about one-tenth in bloom. Analyses of the dry matter of the leaves, taken at the time that the first blossoms appear, show 23.06 per cent of crude protein, while average wheat bran contains about 16 per cent only of crude protein. These same analyses show that six days before harvesting the crop the leaves contain 63 per cent of the total nitrogen of that part of the plant above ground. Eight days later they contain 57 per cent, showing a loss of 6 per cent of nitrogen transferred from the leaves to the stem.

ALFALFA FOR PASTURE.

In making his investigations the writer has visited the farms of many large alfalfa growers and of many large feeders who use it for the development of beef, pork, or milk, though they may not grow all they feed. Among these men there was found a wide difference of opinion as to the value of alfalfa for pasture. One very prominent breeder of Angus cattle is positive in his statements that alfalfa should never be pastured, while an equally prominent breeder of Shorthorn cattle maintains that it is the most valuable of pastures when mixed with grasses and other clovers. It is conceded by all that it is an unequaled pasture for horses and hogs, but that it contains an element of danger for such ruminants as cattle and sheep. In the early history of alfalfa in the region east of the Rocky Mountains many farmers and feeders lost their cattle through their ignorance of the fact that it will produce hoven, or bloat, when carelessly pastured. Experience has taught them, however, that it can be used successfully as a pasture, and apparently without danger to the animal, provided that care is taken to see that the animal never goes onto the alfalfa pasture except with a full stomach. Cattle are so fond of this clover that they eat greedily of it, and the tendency is to gorge themselves if they go to the pasture hungry. The result is bloat and a loss of the cattle.

Experience also teaches that cattle and sheep must never be turned upon alfalfa pasture while the dew is yet on it or just after a rain. Many cattlemen find that they can accustom their cattle to alfalfa

pasture by allowing them to feed for a few minutes each day at first and by gradually lengthening the period until they can eat alfalfa from the pasture with apparent impunity, though the element of danger is never entirely removed.

In this connection the experience of a very prominent breeder of Shorthorn cattle who has made a success in the show ring and who is also a feeder on a large scale will be of interest. For the past sixteen years he has made a practice of sowing alfalfa with other clovers and grasses, so that he has a rich pasture, which keeps his cattle in the highest possible condition and with absolutely no danger from bloat. At least, he states that in this period of sixteen years he has never lost an animal nor had one affected by bloat from pasturing on this mixed pasture. His combination of seeds for 1 acre of rich bottom land is as follows: Four pounds of alfalfa, 3 pounds of red clover, 10 pounds of orchard grass, 10 pounds of English bluegrass, and 1 quart of timothy. For uplands or those which are less able to maintain heavy seeding he reduces the amounts of seed according to his judgment and past experience, the proportions remaining the same. As this gentleman is a breeder of high-class Shorthorn cattle, and as his Shorthorns and stock cattle are always in fine condition when on pasture, and as his experience in the use of this pasture covers so long a period of time, his practice has been copied by others, who are meeting with equal success.

For the drier regions it is suggested that *Bromus inermis* be substituted for the English bluegrass or orchard grass, or both, as it has practically the same reputation for hardiness as has the alfalfa, and experience teaches that a satisfactory pasture may be made by sowing one-half of this grass and one-half alfalfa.

Alfalfa pastures when properly handled are very enduring, though they should not be pastured the first year and only moderately the second year. If the animals do not serve to restrain the too vigorous growth of the plants, the pasture should be cut with a mower occasionally to keep down the weeds and to prevent the alfalfa from seeding, which is an exhaustive process. The alfalfa should never be closely pastured late in the fall, as it needs a protection for the crowns during the winter. If the crowns are laid bare by close pasturing, the plants will not stand the winter and the pasture will be permanently injured. Animals should never be turned upon the alfalfa after the ground has been frozen and a slight thaw has softened the surface; nor should they be turned on it when the ground is rendered soft from rainfall, as the hoofs of the animals will do material damage to the crowns, with a resulting disaster to the pasture. These remarks should also apply to pasturing hogs, which not only damage the crowns of the plant with their sharp hoofs, but also injure or destroy it by rooting.

However, as alfalfa alone is not recommended for cattle and sheep pasture, but is found to be much more valuable and less dangerous when used as hay or for soiling purposes, it may be interesting to turn to the wider uses of the plant.

ALFALFA FOR SOILING.

As alfalfa grows rapidly, it is available for use as feed early in the season, and as its period of growth is a long one each year, it is equally available for feed late in the season. No plant has been discovered which can equal it when used for soiling. Its use in this manner entirely does away with the danger from bloat which is experienced in pasturing it. Every class of farm animals likes it and eats it greedily, but it is especially valuable for the dairy cow. The small dairyman can keep his cattle inclosed in small area, and, by soiling with alfalfa, can keep them in the best of health and the highest flow of milk and without expense for other feed. A very high authority reports that 10 mature cows giving milk were fed an entire summer on alfalfa from 4 square rods less than 2 acres. A cutting was made once each day and the cows fed twice daily without other feed. This was not an exceptionally prepared plat of ground, nor was the growth more rapid than is ordinarily found on the average Western bottom land. After the alfalfa has thoroughly established itself the amount of feed that will be furnished for soiling purposes on even a small plat of ground is almost incredible. When used for soiling it is the judgment of the writer that the plants should be allowed to wilt somewhat before it is fed, as this entirely removes any danger from bloat. If the alfalfa is of rank growth, is very green, or when wet from showers or dew, it is much better to allow time for it to wither than to assume the risk which would follow the feeding of it under those conditions.

While this may seem to be a cumbersome method of harvesting and not suited to the general farmer or cattle feeder, it still has its uses, and it has been demonstrated that it is much cheaper to grow and harvest alfalfa in this manner than to grow and harvest corn. Alfalfa will yield almost twice as much dry matter per acre as will corn. While corn is more digestible and has a higher feeding value when fat is desired than has an equal amount of alfalfa, it will rapidly exhaust the soil, while alfalfa gathers its stores of plant food from the atmosphere and enriches rather than depletes the soil.

ALFALFA FOR HAY.

Alfalfa has been known to yield as much as 5½ tons of hay per acre, or nearly twice as much as an equal area of corn, while the crop on an acre of corn has a feeding value equivalent to about 3½ tons

of alfalfa hay. Alfalfa is cut about three times, on an average, in the region under consideration during each season, and the first cutting is always the heaviest. The figures representing the yield taken from one field are here given, not as an index of the usual yield, but to show the proportionate weight of the several cuttings. From this field the first cutting yielded 4,600 pounds of hay per acre, the second 3,350 pounds, and the third 3,250 pounds, or a total of 5.6 tons per acre for the season's yield. If the plant is cut so late that a considerable portion of the leaves have fallen, the remainder of the hay will be composed of a large percentage of indigestible vegetable fiber. Should the hay be allowed to mold, or heat, some of the most valuable elements of nutrition will be destroyed. When alfalfa hay is properly cured and housed it does not deteriorate with age, and retains much of the succulent qualities of green grass in the early season. It keeps the digestive organs active and open and has a cooling effect upon the blood. The following table shows the comparative value of alfalfa hay and other common feeds, calculated upon the quantity of digestible protein contained in each:

Feedstuff.	Value per ton when prairie hay is worth—		
	$2 per ton.	$3 per ton.	$4 per ton.
Alfalfa hay (choice)	$7.36	$11.05	$14.73
Alfalfa hay (average)	6.05	9.08	12.11
Red-clover hay	3.88	5.82	7.77
Orchard-grass hay	2.74	4.11	5.48
Millet hay	2.57	3.85	5.14
Timothy hay	1.65	2.48	3.31
Sorghum hay	1.37	2.05	2.74
Corn fodder (stover)	1.14	1.71	2.28
Oat straw	.91	1.37	1.82
Wheat straw	.45	.68	.91
Sugar beets	.62	.94	1.25
Mangel-wurzels	.57	.85	1.14
Wheat bran	7.02	10.53	14.04

This table is quoted from Hon. F. D. Coburn, secretary of the Kansas Board of Agriculture, and shows that the choice alfalfa is superior in feeding value to wheat bran, while the average alfalfa hay is but little inferior to it. Animals accustomed to alfalfa seem never to tire of it, and many instances are known where animals will leave fresh grass pastures and feed from a stack of alfalfa hay.

Analyses of the dry matter in alfalfa shows the digestible portion of the leaves of the plant to be 51.75 pounds per hundredweight of hay and the digestible portions of the stems to be 51.27 pounds per hundredweight of hay. While the leaves and stems are nearly equal in the amount of digestible matter, the same analyses show that the nutritive ratio of the leaves is 1:4.5, while that of the stems is 1:7.2,

which is a very much wider ratio and would be suitable for horses at work, while the leaves are better adapted to the needs of young and growing stock or of dairy cows.

ALFALFA MEAL.

There has recently grown up in the region named a number of factories, with more or less expensive machinery installed, for the purpose of grinding the alfalfa hay into meal. In order to accomplish this it is necessary that the hay be kiln dried, and even then it is ground at the expense of great power. Hay, as ordinarily made, is not suitable for the manufacture of alfalfa meal, because it contains too much moisture, which renders it exceedingly difficult to grind and more liable to spoil. Experiments made at different experiment stations and also by private individuals have shown that alfalfa meal, when balanced with a corn ration and some kind of roughness rich in carbohydrates, makes a very satisfactory ration for fattening stock, but a prominent cattle and horse breeder who annually harvests 2,000 acres of alfalfa says that, in his experience, the cattle themselves make a very good mill to grind the alfalfa and he finds it too expensive to grind it by other power. He confesses that he has had no very great experience with alfalfa meal as sold commercially, but thinks that the consumer pays a good price for its preparation. The commercial article is made from selected alfalfa and mixed with sugar-beet molasses in the proportion of 75 per cent alfalfa and 25 per cent molasses. The product contains from 15 to 17 per cent of protein and about 50 per cent of carbohydrates and fat. It is being used by numerous feeders in the preparation of their show animals of different breeds because of its combination of the alfalfa, which is the best milk, bone, muscle, egg, and flesh producer known, with a palatable fat-forming substance, which makes it an attractive feed for animals of all classes. The factories manufacturing this product are generally busy to the limit of their capacity, and one of them is reported as turning out as much as 13,000 pounds per day. Some experiments recently made at the Nebraska Experiment Station show that in feeding pigs the largest daily gains were made on corn and shorts, but that a gain practically equivalent was made at a much lower cost where either cut or ground alfalfa was substituted for shorts in the ration. The cheapest gains were made on corn and cut alfalfa.

ALFALFA FOR HORSES.

That alfalfa is a valuable feed constituent for horses may be seen by the portraits of World's Fair prize winners which accompany this article. These horses were grown from colthood to maturity on Kansas alfalfa, and they were fitted for the great contest for Perche-

ron supremacy on balanced rations, in which alfalfa was a prominent factor. The owner of the stallion Casino is a very successful grower and feeder of alfalfa, and he reports that a daily gain of 5 pounds is no uncommon experience in the fitting of his animals on this plant. Of course, he uses a balanced ration, and, as alfalfa is too rich in protein for the mature horses, he balances the ration by giving them an allowance of corn fodder, Kafir-corn fodder, or some other roughness rich in carbohydrates. The writer was shown one mare on this farm that made a gain of 6 pounds per day for thirty days and a number of stallions that averaged 5 pounds per day for a like period. The ration fed these animals is composed of corn chop, alfalfa, and corn fodder, varied occasionally with other feeds in which the relative value is maintained. A little salt is thrown into the feed each time, and the animal is given free access to an abundance of salt at all other times. These horses are pastured on alfalfa during its season, and, when fitting them for sale or show, the owner is careful to select only choice alfalfa to give them and retains the tops and bottoms of the stacks to feed to his stock cattle. Horses and mules thrive on alfalfa pasture and will make more growth and make it quicker per acre than upon any other pasture now known. While, as stated before, alfalfa is too rich a food for mature horses unless used in combination with some other roughness, it is an excellent feed for young horses, as it seems to contain just the elements necessary to develop bone, muscle, and consequent size. Caution should be used, however, in feeding alfalfa to horses, particularly if they have not been accustomed to it. Like other concentrated feeds, is seems to stimulate all the physical processes to such an extent that various disorders of the digestive system may appear. This is particularly noticeable in the urinary and perspiratory glands. It should be fed in moderation and mixed with other roughness to work and driving horses, though it is a common practice among farmers in the Southwest to feed alfalfa as the only roughness, and the writer has known of livery stables in this region where no other hay is used. This, however, is not to be recommended. When alfalfa is fed to horses in considerable quantity the grain ration must be proportionately reduced and an abundance of other roughness furnished. When horses have attained a mature age and it is desirable to change from other hay to alfalfa, this change must be very gradual, and the alfalfa selected for this purpose should be more advanced in growth at the time of cutting than that which is to be fed to cattle or sheep. As a general statement, very ripe alfalfa hay is the best to use for work horses and driving horses, while that prepared in the usual way—that is, cut when the field is about one-tenth in bloom—is better for the colts. In any event, horses that are fed alfalfa hay must be given abundant exercise.

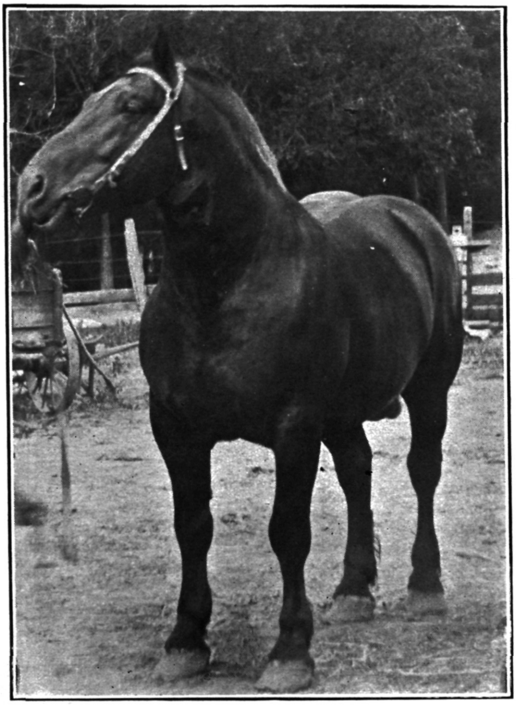


FIG. 1.—PERCHERON STALLION CASINO (45462) 27430.

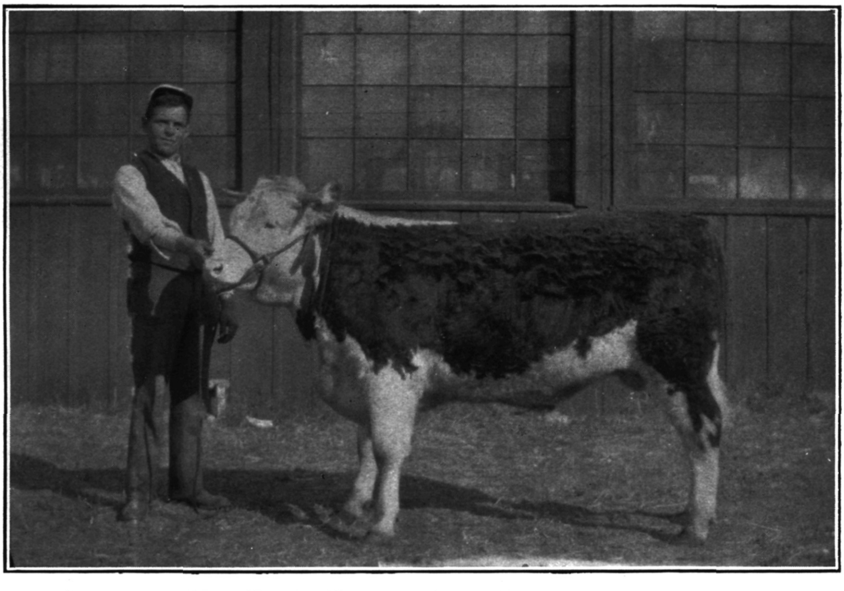


FIG. 2.—HEREFORD STEER PROGRESS.

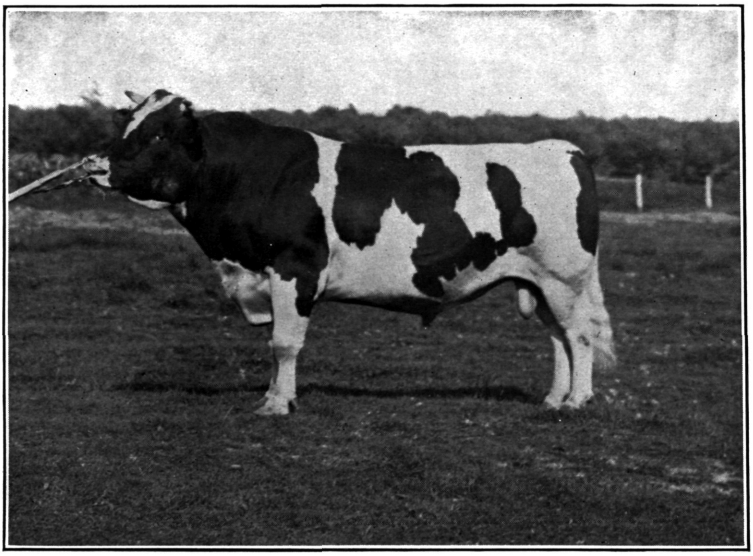


FIG. 1.—HOLSTEIN-FRIESIAN BULL ETHEL ALEXANDER II SIR NETHERLAND 26423.

Winner of second prize in class at the Louisiana Purchase Exposition, 1904. Fitted on alfalfa.

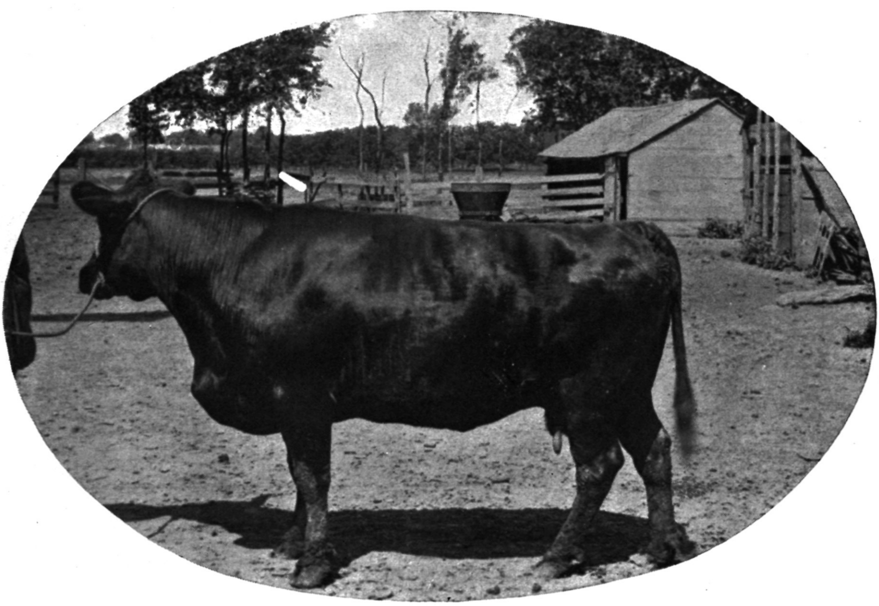


FIG. 2.—RED POLLED COW BRIGHTNESS 10043.

This cow was a prize winner and was fitted on alfalfa.

ALFALFA FOR DAIRY COWS.

While the alfalfa plant contains an element of danger for such ruminants as cattle and sheep if fed as pasturage, it is one of the most valuable plants for this same class of live stock after it has been properly prepared, and used either as a soiling crop or as hay. Indeed, its value as a feed for cattle is not yet fully appreciated by our farmers generally, although locally it is held in high esteem. This plant, even in its dried state when fed as hay, affords a happy combination of richness and succulence that is especially adapted to cattle and sheep. It is very palatable, very easily digested, has a cooling and laxative effect, and produces butter fat similar in quality, texture, and flavor to that produced by green pasturage. In addition to this it is the cheapest of all good feeds. Most highly is it valued perhaps by the average dairyman, for the reason that when fed with corn fodder, Kafir corn, straw, or other cheap roughness in the ordinary methods practiced by farmers, it forms a nearly perfect-balanced ration, and relieves the feeder of the difficulties which most men encounter in trying to figure out a balanced ration. A milch cow seems to be able to determine for herself just how much alfalfa and corn or alfalfa and ground Kafir-corn seed she will eat in order to balance the ration. In fact, alfalfa hay is the only single feed that can be used with corn or Kafir-corn seed to make a properly balanced ration for milk production. The Kansas Experiment Station found that by feeding this hay to dairy cows they were able to produce butter fat at 11.9 cents per pound. When they did not have the alfalfa hay to feed, and the rations were balanced with concentrates purchased for the purpose, it cost as high as 17 cents per pound to produce butter fat. Alfalfa hay may be fed to dairy or other cattle throughout the year, but a better practice is to use the alfalfa for soiling during its growing season, especially during the hot and dry months of the late summer and early fall when the pastures become dry and the grass wiry. At the Kansas Station it was found that 10 head of cattle consumed 77,145 pounds of alfalfa, fed as a soiling crop during a period of seventy-four days. When the cost of the grain ration was deducted and the butter fat was valued at creamery prices and the skim milk at 15 cents per hundred pounds, the green alfalfa was found to have netted the station $25.26 per acre. In 1900 the region in which this station is located suffered from a season of dry weather which lasted from about the middle of June until the middle of July. The tame grasses dried up and the wild grasses became fibrous and woody, while the cattle suffered from the heat and a pest of flies to the extent of causing them to refuse to pasture more than an hour or two each day, and some days they would

not leave the shade of the trees. There were 21 head of milch cows in the herd, which were yielding 289.8 pounds of milk per day. The professor in charge began the practice of soiling about the 20th of June and, after a lapse of three weeks, he found that the cows had actually made a slight increase in yield of milk, although other cows in the neighborhood which had not been so treated had decreased their milk flow from 15 to 20 per cent.

Herewith are shown pictures of dairy and dual-purpose cattle that were notable prize winners at the World's Fair and that were fed and fitted on alfalfa. The Holstein-Friesians shown were fed and developed on alfalfa in central Kansas, and the owner had the satisfaction of retiring from St. Louis with nearly $2,000 in prize money won on his exhibit of 14 head in a competition with the world.

The States of Kansas and Nebraska now claim to be the homes of two of the largest creamery companies in the world, one of which has a daily capacity of 75,000 pounds of butter at its central plant, while its total output from all its churning stations probably amounts to more than 100,000 pounds of butter per day during the height of the season. These great companies have been made possible by the existence and value to the dairy farmer of the alfalfa plant in this region.

ALFALFA FOR STOCK AND FATTENING CATTLE.

That alfalfa has revolutionized methods of feeding beef cattle is abundantly shown by the everyday practice of farmers and feeders in the region where it grows. The former practice of giving fattening cattle all of the shelled or ground corn or Kafir-corn seed they could eat and allowing them to balance their own ration by eating all the prairie hay or other roughness they desired has fallen into disuse, because the farmers and feeders have learned that both corn and Kafir corn are very rich in starchy matter and very poor in protein, and that very large amounts of feed and a long period of feeding are necessary to accomplish the desired results, and because also they have learned that by using alfalfa they have a cheaper feed which will make cheaper beef in a much shorter period. The experience of a very successful feeder may be here quoted as typical of the general practice. This farmer feeds several hundred head of cattle each year and his practice is to carry his stock cattle through the winter by feeding them low-grade alfalfa hay, such as is found at the tops and bottoms of stacks, to which is added oat straw, sorghum hay, corn fodder, prairie hay, or other cheap roughness. The daily ration allowed for each animal is about 25 to 30 pounds of alfalfa and 5 to 10 pounds of other roughness, and from this he makes a gain of from one-half to 1 pound per day for each animal without giving them any grain or other feed of any kind. When the cattle are ready to fatten

for market it is only necessary to add corn chop to this ration, and they are ready for shipping in a very short time.

Baby beef, which has become so popular and profitable in the West, has been made possible by alfalfa. Cattle prepared for fattening by being fed as just described are in the best possible condition and, when ripened with corn, command a high price in the markets. Every farmer who wishes to save all the valuable food substances that exist in his corn and alfalfa will feed the two together, so that what one lacks will be supplied by the other. In this way beef and pork can be grown for the farmer rapidly and at the lowest possible cost. In this connection we quote from a letter lately received from the largest packing house in the United States in regard to the value of alfalfa as a feed for market cattle:

It is customary for our buyers to go over every afternoon when they have nothing else to do, and see the cattle killed that they bought the day before. They seem to think from the feeding qualities of alfalfa that it is the greatest feed with a ration of corn that cattle can have. We can not say that we have ever bought any cattle fattened entirely on alfalfa, but, to come down to the meat, for flavor and tenderness we can not go back on good old corn for fattening. From our own experience and from what we can learn we believe that alfalfa has come to stay, and we consider it the best forage in the shape of hay that cattle can have.

In order to show that results indicated above may be obtained from any crop cut from the alfalfa field, we quote from some experiments made at the Utah Experiment Station, in which 18 head of steers were divided into 6 lots of 3 each and fed on different cuttings of the different crops without grain or other feed. This feeding experiment extended from December 20 to February 21, a period of two months. It was found that the early cutting of the first crop required 19.48 pounds of feed for 1 pound of gain; the medium cutting required 61.23 pounds, and the late cutting 47.01 pounds. In the second crop for the early cutting 20.90 pounds were required, the medium cutting 21.33 pounds, and the late cutting 85.32 pounds. The average for both crops showed 20.19 pounds for 1 pound of gain for the early cutting, 41.28 pounds for the medium cutting, and 66.16 pounds for the late cutting. The results in beef per acre were 412.70 pounds for the early cutting, 217.03 pounds for the medium cutting, and 114.99 pounds for the late cutting. The average gains per day per steer for the alfalfa cut at the best time (before bloom) were, for the first crop 0.778 pound, and for the second crop 0.743 pound. The average pounds of feed for 1 pound of gain, when the crop was harvested before bloom, was 19.48 pounds for the first crop and 20.90 pounds for the second crop. These results were practically confirmed by similar experiments conducted at the Arizona Experiment Station. The results obtained at these two stations served to confirm

what has already been quoted from the feeder mentioned—namely, that one-half to 1 pound per day may be expected as the average gain on stock cattle fed on alfalfa alone. Experiments made this year at the Fort Hays branch of the Kansas Experiment Station give the following results:

The experiment was intended to test the value of native feed in the production of baby beef. Last fall 56 heifer calves, very similar in quality, were chosen and divided into 7 lots of 8 calves each. These animals were grade Shorthorns and Herefords, and the lots were made as nearly equal in weight and quality as possible. The preliminary work consisted in giving the calves a small ration of grain daily and gradually increasing it for about two months until they were on full feed. With this grain they were given all of the roughness they would eat. After they were on full feed they were fed twice a day on the rations given in the following table and in such amounts as they would eat up clean. The grain was all ground to a medium degree of fineness, and the lots receiving corn meal were given corn-and-cob meal throughout the experiment, except during the last three weeks, when the cob meal was omitted. The grain and hay used in the experiment was of good ordinary quality, such as was grown on the station farm and those adjacent to it. The experiment lasted one hundred and eighty-two days. In the table it will be noticed that certain facts stand out prominently. The feeding of alfalfa hay makes a great difference in the amount of grain consumed. The experiment shows a gain for alfalfa of $2.50 to $4 per head over sorghum, prairie hay, or straw. The barley and wheat in combination make a good showing. There was a more marked difference in the lots of calves than is shown by the table, though the rank would remain the same as shown by the daily gain. The lots fed on alfalfa developed more evenly than those fed on sorghum, prairie hay, or straw, and hence would have brought a better price on the market. The table is as follows:

Feedstuff.	Beginning weight.	Gain per head.	Daily gain per head.	Feed required to make 100 pounds gain.		Animals in good market condition.
				Grain.	Hay.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Number.*
Corn and alfalfa	399	338	1.85	545	388	8
Barley and alfalfa	401	297	1.62	519	421	6
Wheat and alfalfa	413	284	1.56	404	432	6
Corn and sorghum	397	224	1.23	715	592	4
Corn and prairie hay	406	262	1.43	641	381	5
Corn and oats straw	405	251	1.37	717	354	4
Mixed feeds [a]	403	328	1.80	473	414	7

[a] One-third each of the grains and one-fourth each of different hay.

Experiments just completed at the Oklahoma Experiment Station were made to test the effect of common feed stuffs on native steers, such as are found in the vicinity of the station. These steers were picked up when they were yearlings and roughed along until about the middle of December, when they were put in the experimental feed lots and full fed in a test of one hundred and forty days. This is the fifth year in which these tests have been made at this station, and Prof. F. C. Burtis, under whose direction the experiments are made, says that it has been demonstrated beyond any doubt that alfalfa is by far the most economical rough feed that is known for cattle feeding. In proper combination alfalfa will produce more fat for less money and will do it in a shorter time than any other known roughness. There were five lots of cattle in this experiment, which were fed as follows: Lot No. 1 was fed on cotton seed, alfalfa hay, and wheat straw, and showed a daily average gain of 0.43 pound. Lot No. 2 had cotton seed, Kafir-corn meal, and alfalfa, and made a daily average gain of 0.35 pound. Lot No. 3 received shell corn, cotton-seed meal, prairie hay, and straw, and made an average daily gain of 0.95 pound. Lot No. 4 was rationed on cotton-seed meal and wheat straw, with an average daily gain of 0.14 pound. Lot No. 5 was fed on corn meal and alfalfa. This lot made a daily gain of 2.28 pounds and averaged in weight 1,352 pounds when sold. Such results are obtained everywhere that corn chop or meal is used in combination with alfalfa hay. A prominent breeder and feeder of Angus cattle who lives in that portion of Kansas which yet has a plentiful supply of buffalo grass, states that he recently fed 10 bulls on alfalfa hay, prairie grass, and millet as forage with corn chop, oats, and a little bran for grain. They gained on this feed as high as 140 pounds each per month, but when the alfalfa was omitted from the ration they dropped off fully 25 per cent. He adds:

Alfalfa is the best crop grown in Kansas, and alfalfa hay has no rival when fed in connection with other roughness, such as Kafir corn, sorghum, or corn fodder. In this locality if alfalfa is fed entirely alone it is not good for cattle, as it seems to affect the kidneys and to weaken them. If it is fed on buffalo-grass pasture, it is simply grand. It is a balancer for all forage crops and makes them almost equal to grain.

ALFALFA FOR HOGS.

All good hog raisers are earnest believers in pasture for their animals. The hog is by nature a pasture-loving animal, and breeders and feeders both recognize the fact that the greatest gains at the least expense are made when the animals have an abundance of pasturage. In the East, red clover is a popular plant for the hog pasture.

In the West its place is taken by alfalfa, which is found to be much superior. Alfalfa makes an ideal hog pasture, as it stands the pasturing better than the clover and is a better feed. If about 15 head per acre are allowed to pasture on alfalfa, they will make about an average gain of 100 pounds each during the season, which lasts until about the middle of November. If the weather conditions are suitable, the alfalfa may be pastured by hogs later than this, but the plant must be given some period of rest. The number of hogs mentioned above is much smaller than is found in general practice on such pastures, but if no more than this are turned on the pasture field they will thrive to their utmost capacity, and the owner can occasionally mow the pasture and get hay of quality for horses or for roughing cattle. The effect of mowing is to keep the pasture fresh, which is to the advantage of both the pasture and the pig. While all breeders and feeders unite in testifying as to the value of alfalfa pasture, they are equally enthusiastic in their claims of the value of alfalfa hay for winter feeding or for hogs that are necessarily confined to dry feed lots. Kansas and Nebraska are now known as two of the best of hog-breeding States, and this reputation has been gained by reason of their large acreage of alfalfa. Nowhere has pork been produced of such good quality and such low cost as in the territory where alfalfa thrives, and one might almost venture a prediction that in the near future the cheapest and best pork will all come from the alfalfa fields of the Southwest.

The Kansas Experiment Station made a test of feeding young hogs in a dry feed lot by giving one lot a ration of alfalfa hay in addition to the grain ration to which both lots had been previously accustomed. The two lots of hogs under consideration were fed fifty-six days. The lot fed alfalfa in addition to the grain ration showed a total gain of 812 pounds on 12 head, while that without the alfalfa showed a total gain of 799 pounds on the same number of head. The alfalfa used in this experiment was not of good quality, however. Another experiment at the same station was made by selecting 60 ordinary stock hogs of mixed breeding and of an average weight of 125 pounds and feeding them for sixty-three days on Kafir-corn meal with and without other feeds. The gains per bushel of feed are reported as follows: Lot 1, fed on dry Kafir-corn meal and 7.83 pounds of alfalfa hay, gained 10.88 pounds per bushel; lot 2, dry Kafir-corn meal alone, gained 7.48 pounds; lot 3, wet Kafir-corn meal alone, gained 8.09 pounds; lot 4, whole Kafir corn alone, 8.56 pounds. A little computation develops the fact that this experiment shows a gain in feeding alfalfa hay with Kafir corn to fattening hogs of 868 pounds of pork per ton of the hay. If we value the hay at $3 per ton and the fat hog at 3 cents per pound live weight, the Kafir corn fed alone brought 22.4 cents per bushel. The Kafir corn

fed with alfalfa hay brought 31.4 cents per bushel. The hay used in this experiment was of the best quality, carefully cured with all the leaves on. When these experimental hogs were butchered it was found that lots fed on Kafir-corn meal and alfalfa hay dressed out 79 per cent of live weight with a firmness of the fat far above any other lot and of a good white color not customarily found in corn-fed hogs. The distribution of fat and lean was extra good.

Alfalfa is of special value as a developer and bone producer in young and growing hogs. Professor Henry, of Wisconsin, made an experiment along this line which is very interesting. One lot of pigs was fed on a ration of milk, middlings, and dry blood—a ration rich in both protein and mineral matter, like alfalfa. Another lot was fed on corn—a feed deficient in both. The pigs fed on the first ration named made a gain of nearly one-fifth more than those fed on corn, and their bones were 32 per cent stronger. Experiments made at the stations in Wisconsin, Missouri, Alabama, and Kansas showed that an abundance of protein and mineral matter in the feed of pigs not only increased the strength of the bones, but also increased the development of the muscles and vital organs and showed greater strength and health, with a larger proportion of lean meat in the carcass. In some of the experiments quoted alfalfa was not used to furnish the protein and mineral matter necessary. In others where it was used it is shown that the same results are attained at a very much less cost. Alfalfa hay is exceedingly rich in both protein and mineral matter. A ton of alfalfa hay contains 51 pounds of potash, 44 pounds of lime, and 11 pounds of phosphoric acid; while a ton of corn contains 8 pounds of potash, 3 pounds of lime, and 14 pounds of phosphoric acid. Besides being rich in protein and mineral matter, alfalfa is bulky, which is a very desirable quality where young animals are being forced during the bone-forming period. Many breeders of purebred hogs find that their animals have excellent characteristics in every respect except that of bone. Animals which have been inbred, or line bred, for a long period are likely to be small of bone and to have splay feet. A constant ration of alfalfa will be found to correct these evils and change the nature of the herd in a few generations at most. It is best to begin by feeding the dam on alfafa, so that her pigs may have a right start in life. It has happened in Kansas and Nebraska within the last ten years that there have been at least two seasons when a large part of the territory of these two States was deficient in corn of a quality satisfactory to feeders. The result was that many herds of hogs were carried through the winter almost entirely on alfalfa hay. When spring came it was found that the animals themselves were in good condition and that the litters of pigs were unusually large and strong.

It must not be understood that alfalfa will furnish all of the

mineral matter that is needed for the proper development of the bones in the young pigs. They should receive all the corncob charcoal they will eat in addition to other feeds. This does not apply to the young of any other kind of animal, but does seem necessary in the case of pigs.

The facts here stated have much significance to the hog breeders of the country when they consider that their best market for fine hogs now lies in the alfalfa country. Heretofore this country has been largely devoted to wheat growing and the farmers have not become noted as breeders and raisers of purebred stock, because of the firmly fixed belief in the minds of the early settlers that it was impossible to raise hogs without corn. With the advent of alfalfa and its rapid gain in popularity, this region has opened up as one of the greatest stock-producing sections of our country and a section which has the advantage, with the aid of its alfalfa, of being able to produce marketable hogs in a shorter time and of better quality than any other region with which the writer is familiar.

At the World's Columbian Exposition, held at Chicago in 1893, a Kansas breeder of Poland-China hogs secured seven prizes on eight animals shown. These animals were pastured on rye and wheat during the late fall and winter months and were fed alfalfa during the other eight months in the year. Most of the Kansas hogs that won prizes at St. Louis in the Louisiana Purchase Exposition were raised on alfalfa pasture and hay.

The Nebraska Experiment Station divided 20 pigs of uniform type and condition into 4 lots of 5 each and fed them on different rations. The result was that the lot which was fed on corn alone made an average gain of 0.93 pounds per day, that fed on corn and skim milk gained 1.57 pounds, that fed on corn and shorts gained 1.20 pounds, and that fed on corn and alfalfa gained 1.20 pounds. With the value of $7 per ton for the alfalfa hay, $12.50 per ton for the shorts, corn at 30 cents per bushel, and skim milk at 15 cents per 100 pounds (the usual prices at the time of the experiments), and an addition of 6 cents per 100 pounds for grinding the corn, each 100 pounds of gain in the several lots of hogs cost as follows: Lot 1, fed corn only, $4.48; lot 2, corn and skim milk, $3.97; lot 3, corn and shorts, $3.53; lot 4, corn and alfalfa, $3.40. It will be seen by the figures given that the average gains made by the lots fed on corn and shorts and on corn and alfalfa were the same, but that the corn and alfalfa lot was 13 cents per 100 pounds cheaper than those fed corn and shorts, and $1.08 per 100 pounds cheaper than the lot fed on corn alone. Stated in a different way, the experiment shows that at the time and under the market conditions obtaining when it was conducted, skim milk made the corn bring 4 cents more per bushel, wheat shorts made it bring 8 cents more, and alfalfa 9 cents more. This means that in a State like

Nebraska the substitution of alfalfa for one-fifth of the corn that is usually fed to hogs would bring more than $1,000,000 per year of added wealth to the State. A slaughter test made of these pigs showed that the lot receiving alfalfa had a greater development of muscle and of vital organs, and a test of the strength of the bones was made which showed that the bones of the corn-fed pigs broke at an average of 325 pounds, when the thigh bone was supported at each end and pressure applied in the middle by a testing machine. In the case of the corn and alfalfa pigs the average breaking strain was found to be 510 pounds. From these facts it is evident that the breakdowns which often occur in heavy corn-fed hogs are the fault of the feed rather than of the animal. This same experiment showed that the size of the bone was slightly greater in the corn-fed hog than in the corn and alfalfa fed hog, but the testing of the strength of the bones showed that the corn-and-alfalfa pig had much denser bone, and that these were enabled to withstand nearly 200 pounds more pressure before breaking.

In preparing alfalfa hay for hogs it is better to cut it early so that a larger proportion of leaves may be saved and consequently a larger proportion of protein conserved. As was heretofore mentioned, a late cutting, after the leaves have fallen somewhat and the stem hardened, is better for horses, but for pigs, especially growing pigs, the crop should be so harvested as to save the largest number of leaves. Experience teaches also that the third or fourth crop is better for pigs because it is softer and more palatable. It is always wise to provide some kind of a trough or rack with a floor in it for feeding alfalfa to hogs; otherwise the leaves, which are the most valuable portions of the plant, are lost by being trampled in the mud and the more woody proportions remaining are not eaten so greedily by the hogs.

Alfalfa is an ideal feed for brood sows, and when it is so used the hard-luck stories about the loss of pigs, which are so frequent in the district where corn alone is fed, will not be heard. Experienced breeders as well as veterinarians both assure us that a thrifty condition is the best preventive of disease. Hence it follows that the breeder and feeder who is liberal with his rations of alfalfa is not troubled so frequently or seriously with swine diseases.

ALFALFA FOR SHEEP.

Practically all that has been said about the value of alfalfa for cattle will apply when sheep are considered, except that sheep are much more susceptible to bloat from eating green alfalfa than are cattle. Hence it is that alfalfa as a sheep feed is used almost entirely in the form of hay. Sheep fed on alfalfa with proper grain rations and other roughness make the same rapidity in growth as do other

animals and have a larger yield of fleece. They also develop much younger, so that the sheep raiser who grows them for mutton can place them on the market much earlier than he can with any other combination of feed. Sheep are extremely fond of alfalfa, as are all domestic animals, and nothing has been discovered which will take its place in the developing growth of the animal and production of mutton and of fleece, but it must always be fed as a hay.

OTHER USES OF ALFALFA.

Alfalfa in its green state, or when used as hay or ensilage, is a first-class poultry food. Poultry will pasture on it during the summer and thrive. The considerable number of insects which they get while pasturing only adds a desirable item to their bill of fare and helps them in their development and their egg-laying powers. As alfalfa remains green throughout the winter, it makes an excellent winter pasture for fowls, although, of course, it will not do to allow them to pasture it closely or the crop will be injured if not destroyed. In the winter season poultry which have access to stacks of alfalfa or to barns or sheds in which it is stored make a better growth and continue egg laying much longer than do those which do not have access to it. Poultry will feed voraciously on the dry leaves of the alfalfa plant when they have access to it, and much of the fine material shattered off from the hay in the hay mow may be used to great advantage in feeding them. As this shattered material is mostly leaves, it is the best part of the plant and can be fed alone or mixed with other feed. The nitrogenous element of alfalfa is just what is needed for the development of the young fowls, as well as for the production of eggs, and a number of so-called poultry foods are said to be composed in part of ground alfalfa. It is best for poultry to use the last cutting of alfalfa, as it is softer in texture, has a larger proportion of leaves, less woody matter, and is more succulent than any other cutting. While poultry of all classes will eat alfalfa hay, or at least the leaves from it, and thrive, it is undoubtedly a better practice to chop it or grind it and mix it with a grain ration. A good practice is to steep the alfalfa hay in hot water and let it stand for several hours before feeding. If this is done and the grain ration mixed with it, the effect is practically the same as though the birds were fed on the green alfalfa. Corn meal and ground alfalfa, steeped in hot water or steamed to soften it, makes an ideal balanced ration for winter poultry feed. The real value of the alfalfa plant for poultry is not yet appreciated.

In many sections of the West, especially on the plains of Kansas, Nebraska, and Oklahoma, farmers find a very profitable investment when they buy a few stands of honey bees. As the alfalfa grows rapidly and blooms early, and as its season of growth is a long one, it is

found to be one of the best and most profitable plants yet discovered for bee pasture. It is a common practice in some of the smaller towns in the alfalfa region for residents to maintain a considerable number of colonies of bees which pasture on the alfalfa fields belonging to their neighbors. The bees will begin working on the alfalfa fields early in June in the more southern parts of the alfalfa region, and may continue until late in October, and the honey produced from this source is superior to that derived from the buckwheat, white clover, or sweet clover, although it is darker in color. In fact, it is the belief of the writer that there is no honey produced from any source that equals in quality and flavor that from the alfalfa plant. Climatic conditions which retard or too greatly accelerate the growth of the plant will have their influence on the production of honey. If the season is too dry the blossoms seem to contain little honey, while if it is too wet the honey seems to be greatly diluted. In a favorable season 100 pounds per stand of bees would be a common yield. The writer has a neighbor who lives in the suburbs of a city of 45,000 people and who has a number of stands of bees on his town lot. During the season of 1903 his bees produced for him 2 tons of honey, chiefly gathered from the near-by alfalfa fields, on samples of which he secured first prize at the State fair on an exhibit of alfalfa honey.

THE TAPEWORMS OF AMERICAN CHICKENS AND TURKEYS.

By B. H. Ransom, B. S., A. M.,
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The important subject of tapeworms of poultry has received but little attention in this country. Only one extensive paper concerning these parasites has appeared in the United States, that of Stiles (1896), which is now out of print, and also somewhat out of date, especially in regard to American forms. This lack it is hoped will be supplied, in part at least, by the present article, which includes complete descriptions of all species of tapeworms now known to occur in chickens and turkeys in this country, with a key for their identification, and in addition the following preliminary remarks, taken from Stiles, in regard to life histories, prevention, treatment, etc.:

LIFE HISTORY AND SOURCE OF INFECTION.

The life history of a number of forms is known. (The life history of none of the forms so far reported in this country has yet been worked out.) So far as yet worked out, the larval stage is in every case a cysticercoid and lives in some invertebrate (snail, insect, crustacean, or worm). There are no grounds for believing that poultry can become infected with tapeworms directly from the eggs contained in the droppings.

The life history of these worms agrees with the life history of other tapeworms; the ova of the parasites are voided with the excrement and are swallowed by an intermediate host; the six-hooked embryo (known as an oncosphere) contained within the eggshell then bores its way from the intestine into the body cavity of the intermediate host (a worm, snail, crustacean, or insect) and develops into a larval form (known in this case as a cysticercoid). This larva develops into an adult worm when swallowed by a chicken, duck, goose, etc.

The known or supposed life history has been based upon four different methods of work, i. e.—

(1) Experimental infection of the fowls by feeding to them known larval stages found in invertebrates, and thus raising the adult stage.

(2) Experimental infection of invertebrates by feeding to them the eggs of tapeworms found in birds, and thus raising the larval stage.

(3) Comparison of the hooks upon the heads of adult tapeworms of birds with the hooks of larvæ found in invertebrates, and thus associating the young and the old stages.

(4) Wild speculation as to the intermediate hosts, based upon negative results and totally devoid of any scientific foundation.

Of these four methods of work, the first two give positive proof of the life history when the experiments are successful; the third gives a probability to the statements, but not a proof; the less said about the fourth method the better.

Chickens are known to become infected with one tapeworm [*Davainea proglottina*, not yet reported in this country] through eating slugs (*Limax*). They are supposed to become infected with a second [*Davainea echinobothrida*] through eating snails (*Helix*); by a third [*Choanotænia infundibuliformis*], through eating flies, and by a fourth [*Amœbotænia sphenoides*, not yet reported in this country] through eating earthworms.

Ducks are known to become infected with two worms through swallowing fresh-water crustaceans, and are supposed to become infected with three other tapeworms in the same way; another tapeworm is supposed to be transmitted to them through flies.

Geese are supposed to become infected with five species of tapeworms by swallowing small fresh-water crustaceans.

Nothing is known in regard to the source of infection of the tapeworms of pigeons and turkeys, but investigations in this field should be based upon the tapeworms of chickens.

THE RELATION OF THE TAPEWORMS OF WILD BIRDS TO THOSE OF THE DOMESTICATED FOWLS.

Only two of the chicken tapeworms have as yet been recorded for wild birds, but the majority of the tapeworms found in the domesticated ducks and geese are also recorded from closely allied wild birds. Besides these forms, however, many species have been described in wild birds which are not known to occur in the domesticated fowls. This renders the economic side of the question of avian cestodes extremely complicated and demands a thorough study of the parasites of wild birds in connection with those of our domesticated fowls.

SYMPTOMS AND PATHOLOGY.

From a standpoint of symptomatology practically nothing is known upon this subject. In general, however, it may be stated that aquatic birds are less affected by the presence of tapeworms than land birds, that young birds suffer more than old birds, and that, although a fowl may harbor a small number of tapeworms without showing any appreciable effects, a heavy infection injures the health and may result in death, as has been abundantly demonstrated by epidemics observed in different parts of the world. It has also been noticed that poultry are more severely infested in wet years than in dry years, and the general application may be made that poultry kept in damp places will be more heavily infested than fowls kept in dry places. All of these statements are general principles of parasitology.

Zürn (1882, p. 17) gives the symptoms as follows:

If numerous tapeworms are present in the intestines of young or old fowls, a more or less extensive intestinal catarrh develops, corresponding to the greater or less number of parasites present.

The intestinal catarrh shows itself, especially in chickens and geese, as follows: The sick animals become emaciated, although the appetite is not especially disturbed. At times the appetite is even increased. The droppings are thin, contain considerable yellow slime, and are passed in small quantities, but at short intervals. The poultry raiser must direct his attention to these thin, slimy, and often bloody droppings, for if any treatment against the tapeworms is to be undertaken this must be done as early as possible. In observing the droppings it should be noticed whether tapeworm segments or eggs are present. The eggs can be seen, of course, only with the microscope.

After a time other symptoms develop. The sick animals become dull and listless, remain apart from the rest of the flock, the feathers are ruffled, and the wings drop, the appetite is lost, and the birds allow themselves to be easily caught. Although it was stated that in the beginning of the trouble the appetite is not disturbed, the sick animals develop an intense thirst for cold water. When it rains, they run under the eaves in order to catch water, and in winter are eager for ice water.

At reading this, some experienced poultry raisers will probably reply that many chickens which are not sick are fond of very cold water. The droppings are also thicker or thinner according to the food. Both of these facts are known to me (Zürn). At the same time I look with suspicion of tapeworms upon every chicken which shows an especial thirst for cold water, and, as for the droppings, the fowls infected with tapeworms have droppings mixed with mucus and blood, and pass their excrements much oftener than other fowls do.

The intestinal catarrh often ends fatally.

Upon postmortem the body is seen to be thin and anemic. The intestine generally contains no food, the mucosa is soft and hyperæmic and covered with reddish yellow, more or less thick, purulent mucus. According to Hertwig, epileptic attacks are frequently noticed in chickens affected with intestinal worms.

The diagnosis by symptoms seems to me very uncertain, and although the symptoms described by Zürn serve as an indication of the disease they can not be taken as proof. The diagnosis by hunting in the droppings for segments of the parasite is less satisfactory than would be supposed, for it is not rare to find chickens badly infested with tapeworms when it has been impossible to discover segments in the manure. This method is rendered doubly uncertain because the color of the segments is about the same as the urine in the feces. Microscopic examination of the feces for eggs is quite a certain though not positive method for diagnosis of tapeworm disease of poultry, but it is thoroughly impracticable for the farmer to attempt it. The best method for the farmer to follow is to kill one of the sick chickens when he suspects tapeworms and to cut out the intestine; he should then open the intestinal tract from the gizzard to the anus, in a bowl of warm water, and look for the parasites.

TAPEWORM-INFECTED FOWLS AS FOOD.

None of the tapeworms of birds are transmissible to man in any stage of their development, and the presence of tapeworms in the intestine of fowls does not in itself warrant the condemnation of their bodies as an article of food.

PREVENTION.

From the nature of the intermediate hosts (fresh-water crustaceans) of the tapeworms of the aquatic birds it is evident that nothing can be done to prevent the introduction of larval tapeworms into ducks and geese, if these animals are allowed to visit ponds. Confining the animals to frequently flushed artificial tanks will, however, prevent tapeworm infection.

With chickens the outlook is somewhat better. An extermination of slugs will insure immunity against *Davainea proglottina*, but no precise directions can be given to prevent chickens from becoming infected with other tapeworms until the life history of these parasites is better understood. It will be well, however, to keep chickens housed in the morning until the sun is well up and the ground is dry, for they will thus be less likely to meet with the supposable intermediate hosts of other worms.

Absolutely nothing can be done at present looking to a prevention of the transmission of tapeworms of wild birds to the domesticated fowls through known or unknown intermediate hosts, except to prevent the domesticated ducks, geese, etc., from visiting ponds.

There is, however, considerable outlook for improvement if different kinds of fowls are alternated in succeeding years upon the same ground, or if the runs and yards of fowls are occasionally changed.

The safest plan to prevent the spread of poultry worms would be to destroy the manure from infected fowls. If one is not willing to do this, however, because of its commercial value, he should at least take steps to prevent further infection from it. If the sick chickens are confined to a comparatively small space, their droppings can easily be collected and placed in a strong barrel, to which the access of snails, slugs, worms, etc., should be guarded against. It is not known how long the eggs of poultry tapeworms will live, but it seems very doubtful to me whether they could live many months in such a barrel if placed in a dry spot. It seems almost certain that they could not live through the winter. The temperature required to kill the eggs has likewise not yet been determined, but probably 50° to 60° C. (122° to 140° F.) would suffice. Sulphuric acid (10 per cent) or quicklime is an excellent disinfectant for feces containing eggs of parasites.

The proper care of the manure from infected fowls is unquestionably the most important preventive measure against tapeworm disease.

TREATMENT.

The treatment of tapeworm disease in the domesticated fowls must for the present be more or less experimental, as the records in this line are extremely limited.

The first rule to be carried out in all cases of diseased animals, whether chickens, turkeys, geese, ducks, or others, is to isolate them from the rest of the flock and keep them confined until they have recovered. The second rule is to destroy the droppings of all animals known to be infected with parasites, or, if the manure is needed as fertilizer, it should be treated in such a manner so as to kill the ova. These two rules can be easily carried out, and if a poultry raiser or a stock raiser is not willing to set aside a small yard for the isolation of the sick animals, where their droppings can be easily collected and taken care of every day, it is almost useless for him to administer anthelmintics to his fowls or other animals.

The chief drugs used against tapeworms are extract of male fern, turpentine, powdered kamala, areca nut, pomegranate-root bark, pumpkin seeds, and sulphate of copper (bluestone).

Areca nut.—According to Zürn, powdered areca nut is the best tapeworm remedy for fowls, but he calls attention to the fact that turkeys are unfavorably affected by this medicine.

Zürn advises the administration of powdered areca nut in doses of 2 to 3 grams (= 30 to 45 grains) mixed with butter and made into pills.

Liquid extract of male fern is very effectual against tapeworms. Hutcheon advises a teaspoonful for young ostriches 3 to 4 months old, to a tablespoonful for a full-grown ostrich; it may be made into a pill with flour.

Turpentine may be given to ostriches in doses of a dessertspoonful for chicks 3 to 4 months old, to 2 tablespoonfuls for a full-grown bird; its action is much more effective when combined with a purgative, such as linseed or castor oil. (Hutcheon.)

As a safe rule, we can adopt 1 teaspoonful (about 4 c. c. = about one-eighth of an ounce) to 3 teaspoonfuls (about 12 c. c. = about three-eighths of an ounce) as the dose for chickens, the size of the dose being determined by the size of the chicken.

Powdered kamala.—Mégnin states that very good results followed the use of this drug, mixed with the food, against tapeworms of pheasants. Hutcheon advises for ostrich chicks 1 month old, 1 dram; 2 months old, 1½ drams; 3 to 4 months old, 2 drams; 18 months old, 1 ounce; a full-grown ostrich, 2 drams more. It does not require to be mixed with a purgative. Powdered kamala may be given mixed in a little milk or water or it may be made into pills with a little flour and water.

Pumpkin seeds.—These, according to Zürn, are not well borne by turkeys and not always by chickens, but it would be well to experiment further with them.

Pomegranate-root bark.—Very effective against tapeworms in ostriches, but must be given in large doses and followed by a purgative. (Hutcheon.)

Perroncito advises the following treatment for tapeworms in chickens (dose for one chicken):

(1) Aloes (socotrine or caballine), 15 to 20 centigrams. The animal is fasted the same day.

(2) Pumpkin seeds, 40 to 50. Administered to each chicken on the second day.

(3) Male fern, powdered, 100 grams. Mixed in bran.

All of the above medicines should be procured as fresh as possible. Many failures in treating for tapeworms are due to the fact that old drugs have been used which had lost their anthelmintic properties.

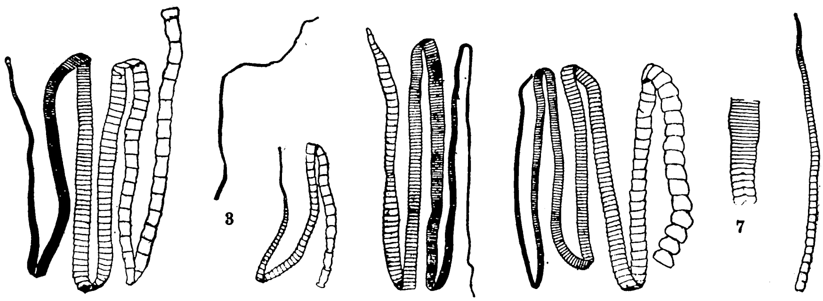

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FIG. 2.—*Metroliasthes lucida.* Entire worm. Natural size. Original.
FIG. 3.—*Hymenolepis carioca.* Entire worm. Natural size. Original.
FIG. 4.—*Choanotænia infundibuliformis.* Entire worm. Natural size.
FIG. 5.—*Davainea tetragona.* Entire worm. Natural size. Original.
FIG. 6.—*Davainea echinobothrida.* Entire worm. Natural size. Original.
FIG. 7.—*Davainea echinobothrida.* Portion of posterior end showing openings between the segments. Natural size. Original.
FIG. 8.—*Davainea cesticillus.* Entire worm. Natural size. Original.

While there is little information available to add to the above discussion of treatment and prevention of tapeworm diseases in poultry, our knowledge of the species of poultry tapeworms found in this country has advanced somewhat, so that instead of only two species, as reported in Stiles's paper, there are six easily recognizable species now known to occur in American chickens and turkeys,[a] which may be identified by means of the following key:

[a] The tapeworms of American domesticated ducks, geese, and pigeons have as yet not been investigated.

Key for the identification of tapeworms occurring in chickens and turkeys in the United States.

1. Head unarmed 2
   Head armed 3
2. Maximum width of worm, 1.5 to 2.5 mm.; genital pores irregularly alternate; hindermost segments longer than broad and containing a single large spherical egg capsule .... *Metroliasthes lucida.*
   Maximum width of strobila less than 1 mm.; genital pores unilateral on the right-hand margin of the strobila; all of the segments broader than long; eggs contained in a sac-like uterus which fills nearly the entire gravid segment .... *Hymenolepis carioca.*
3. Rostellum armed with a single row of 16 to 20 hooks, 20μ to 30μ long, with long dorsal root and short ventral root .... *Choanotænia infundibuliformis.*
   Rostellum armed with numerous small hooks, with short dorsal root and long ventral root 4
4. Suckers unarmed; eggs not grouped together in egg capsules; in the hindermost segments the uterus is broken up into numerous sacs, each of which contains a single egg; rostellum very broad (over half as broad as the head) and flat or hemispherical, armed with 400 to 500 instable hooks 7μ to 10μ long; neck very short; anterior segments nearly as broad as or more commonly broader than head .... *Davainea cesticillus.*
   Suckers armed; eggs grouped together in numerous egg capsules 5
5. Rostellum armed with a crown of about 100 hooks, 6μ to 8μ long, arranged in a single row; hooks on suckers 3μ to 8μ long; genital pores unilateral, situated at or in front of the lateral margin of each segment; cirrus pouch pyriform, 75μ to 100μ long .... *Davainea tetragona*
   Rostellum armed with a crown of about 200 hooks, 10μ to 13μ long, arranged in a double row; hooks on suckers, 6μ to 15μ long; genital pores, irregularly alternate or rarely almost entirely unilateral, situated posterior of the middle of the lateral margin of each segment; cirrus pouch, flask shaped, 130μ to 180μ long; causes the nodular disease of the intestines of chickens .... *Davainea echinobothrida.*

Metroliasthes lucida RANSOM, 1900.

SYNONYMY: *Metroliasthes lucida* RANSOM, 1900, pp. 213–226, pl. 13, figs. 1–6; pl. 14, figs. 7–10.

SPECIFIC DIAGNOSIS: *Metroliasthes:* Length, 200 mm. or more. Width of strobila just behind the head, 0.6 mm.; greatest width, 1.5 to 2.5 mm. Most anterior segments five to six times as broad as long; posterior segments about twice as long (2.5 to 3 mm.) as broad (1.5 to 1.8 mm.). Head flattened dorso-ventrally and broader than long, 0.75 mm. broad and 0.58 mm. long. Hooks and rostellum lacking. Suckers well developed, 0.2 to 0.25 mm. in diameter, situated somewhat anteriorly. Neck short, strobilation becoming apparent within a distance of 2 mm. behind the head. Posterior border of each segment prolonged into a short rim which overlaps slightly the anterior border of the following segment. Genital pores marginal and irregularly alternating, one pore in each segment located near the middle of the lateral margin in the younger segments; in older segments, posterior of the middle. Cirrus pouch and vagina are ventral of the dorsal excretory canal and dorsal of the longitudinal nerve and ventral excretory canal.

Male reproductive organs: Testicles 30μ to 100μ in diameter, 20 to 40 in number, arranged in a mass extending transversely across the posterior portion

of the segment between the excretory canals. Efferent canals from the testicles unite to form the vas deferens, which extends forward and forms a mass of coils in the anterior portion of the (young) segment at the base of the cirrus pouch.

Cirrus pouch cylindrical with the distal two-fifths considerably more slender than the proximal portion. Size in the sexually mature segment about 400μ long by 100μ in diameter in its proximal portion and 50μ in diameter in its distal portion. Protractile portion of vas deferens, or cirrus, about equal in length to the cirrus pouch, armed with long powerful spines.

Female sexual organs: Vagina comparatively straight, 6μ to 9μ in diameter; inner portion after copulation becomes swollen and functions as a seminal receptacle. Ovary in the middle of the proglottis posterior of the inner end of the cirrus pouch and anterior of the testes; when fully developed it is plump and rounded, with a convex, more or less lobulated, anterior surface and a concave posterior surface. Shell gland posterior of the ovary. Posterior of the shell gland is the yolk gland. Uterus at first a transverse cord of cells dorsal of the ovary and close behind its posterior edge; when fully developed consists of two prominent spherical sacs lying side by side in the posterior portion of the segment and filled with eggs. A cone-like, fibrous structure para-uterine organ develops in front of the uterus. The eggs in masses are pressed out of the uterus into the para-uterine organ, and the latter then becomes modified to form a capsule closely investing the eggs. This capsule, usually spherical in shape, is a very prominent structure in the segments of the posterior portion of the worm, occupying the middle of the segment in front of the genital pore. The encapsuled eggs are oval with three membranes, a thin inner membrane closely enveloping the embryo, or oncosphere; a thicker middle membrane, 55μ by 35μ in diameter, and a thin outer membrane 75μ by 50μ in diameter. The embryo is 30μ in diameter, and its hooks are 20μ to 25μ long.

LIFE HISTORY.—Unknown.

HOST.—Turkeys (*Meleagris gallopavo*); ? chickens (*Gallus domesticus*).

LOCATION.—Intestine.

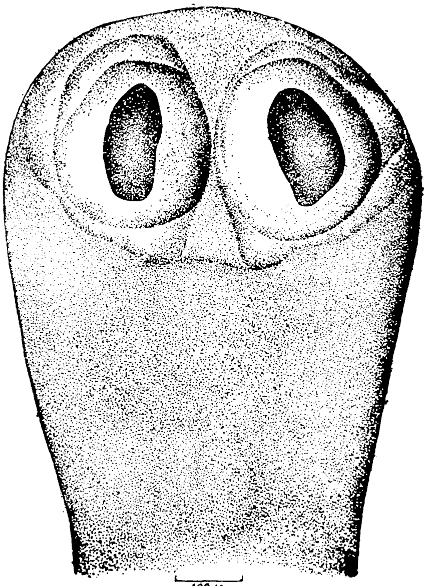
GEOGRAPHICAL DISTRIBUTION.—North America, Europe.

This species seems to be the most common tapeworm of turkeys in this country. It is readily recognized by its unarmed head and the prominent spherical egg capsule in the middle of each of the oldest segments. Its presence in chickens is doubtful.

Hymenolepis carioca (Magalhães, 1898) RANSOM, 1902.

SYNONYMY: [?] *Tænia exilis* DUJARDIN, 1845a, p. 602.—*Tænia tetragona* MOLIN, 1858, p. 139 (in part).—*Tænia* sp. Conard in STILES, 1896, pp. 59–60, pl. 21, figs. 275–276.—*Davainea carioca* MAGALHÃES, 1898, pp. 449–451, figs. 7–12.—*Tænia Conardi* ZÜRN, 1898, p. 460.—*Hymenolepis carioca* (Magalhães) RANSOM, 1902, pp. 151–158, pl. 23, figs. 1–7, pl. 24, figs. 8–10.

SPECIFIC DIAGNOSIS.—*Hymenolepis:* Length 30 to 80 mm. Breadth at neck 75μ to 150μ, at posterior end 500μ to 700μ. Segments three to five times or more broader than long throughout the strobila. Head flattened dorso-ventrally, 140μ to 160μ long, 150μ to 215μ wide, and 100μ to 140μ thick. Suckers shallow, 70μ to 90μ in diameter, unarmed. Rostellum, unarmed, in the retracted position 25μ to 40μ in diameter and 90μ to 100μ in length, with a small pocket opening to the exterior in its anterior portion. Unsegmented neck portion of strobila 0.6 to 1.5 mm. long. Genital pores almost entirely unilateral, a single pore being located in each segment slightly in front of the middle of its right-hand margin.



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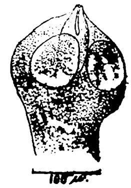

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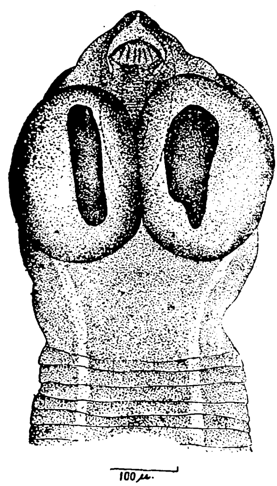

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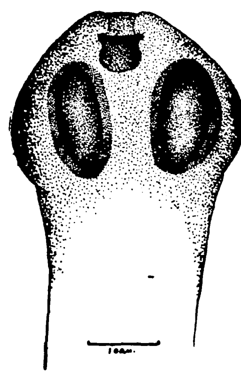

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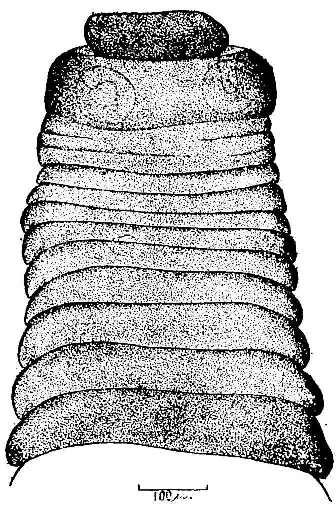

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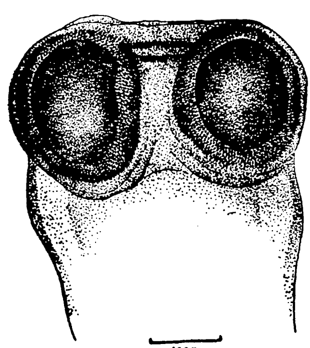

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FIG. 9.—*Metroliasthes lucida.* Head. Enlarged. Original.
FIG. 10.—*Hymenolepis carioca.* Head. Enlarged. After Ransom, 1902, Pl. 24, Fig. 8.
FIG. 11.—*Choanotænia infundibuliformis.* Head. Enlarged. Original.
FIG. 12.—*Davainea tetragona.* Head. Enlarged. Original.
FIG. 13.—*Davainea echinobothrida.* Head. Enlarged. Original.
FIG. 14.—*Davainea cesticillus.* Head and anterior portion of strobila. Enlarged. Original.

Male reproductive organs: Testicles three in number, normally two on the left and one on the right of the median line. On the dorsal side of the inner end of the cirrus pouch the vas deferens is swollen into a prominent seminal vesicle, which may attain a size of 70μ by 50μ. Cirrus pouch in sexually mature segments 120μ to 175μ long by 15μ to 18μ in diameter; almost cylindrical, slightly curved toward the ventral surface of the segment; on the outer surface about 20 longitudinal muscle bands 2μ to 3μ in thickness, very prominent in cross section; vas deferens enlarged within the cirrus pouch to form a small seminal reservoir occupying the proximal two-thirds of the pouch; the distal third of the portion of the vas deferens within the pouch is very slender, about 1μ in diameter and functions as a cirrus. Genital cloaca 12μ to 36μ deep.

Female reproductive organs: Opening of the vagina in the floor of the genital cloaca, ventral and posterior of the cirrus opening. First portion of vagina very narrow, 1μ in diameter. A small vaginal sphincter 8 to 10μ from the vaginal opening. On the inner side of the sphincter the vagina gradually increases in diameter, and in sexually mature segments is swollen out into a prominent seminal receptacle which extends forward to the anterior border of the segment and inward a considerable distance beyond the proximal end of the cirrus pouch. Ovary faintly bilobed or trilobed in the posterior half of the proglottis, extending nearly across the segment when fully developed. Yolk gland spherical or ovoid, 30μ to 40μ in diameter, situated near the median line of the segment, and posterior and dorsal of the ovary. Uterus at first a solid cord of cells extending transversely across the segment along the anterior border of the ovary; becomes hollowed out and grows backward on the dorsal side of the ovary; in gravid segments occupies nearly the entire segment and is filled with eggs. Eggs in gravid uterus spherical or oval; with four thin membranes, the two middle membranes often approximated to form a single membrane; diameter of outer membrane 36μ by 36μ to 75μ by 70μ, of outer middle membrane 30μ by 30μ to 65μ by 60μ, of inner middle membrane 26μ by 26μ to 40μ by 35μ, of inner membrane 24μ by 16μ to 29μ by 21μ, of oncosphere 18μ by 14μ to 27μ by 19μ; length of embryonal hooks, 10μ to 12μ.

LIFE HISTORY.—Unknown.

HOST.—Chickens (*Gallus domesticus*).

LOCATION.—Small intestine.

GEOGRAPHICAL DISTRIBUTION.—North and South America, Europe.

Hymenolepis carioca is readily recognizable on account of its very slender and almost threadlike form. It is very difficult to obtain complete specimens on account of the delicacy and fragility of the worm, and the head is commonly broken off and lost. Several thousand individuals of this species are sometimes found in a single chicken, and in such cases the health of the fowl is likely to be very seriously affected. The writer has seen one instance in which the entire small intestine from beginning to end was filled and completely occluded by a mass of these worms.

Choanotænia infundibuliformis (Goeze, 1782) RAILLIET, 1896.

SYNONYMY.—[?] *Globus stercoreus* SCOPOLI (1772), p. 127.—[?] *Tænia infundibulum* BLOCH (1779a), p. 555, pl. 12, figs. 3–5 [probably in part synonymous with *T. infundibuliformis* Goeze].—[?] *Tænia avium* PALLAS, 1781, p. 87, pl. 3, figs. 29, 30.—[?] *Tænia articulis convideis* [misprint for *conoideis*, cf. Bloch, 1782, table of contents] BLOCH, 1782a, pp. 13–14, pl. 3, figs. 1, 2 [probably in part synonymous with *T. infundibuliformis* Goeze].—*Tænia infundibuliformis* GOEZE, 1782a, pp. 386–391, pl. 31A, figs. 1–6.—*Tænia cuneata* BATSCH, 1786a, p. 190,

figs. 117, 118.—[?] *Tænia conoidea* SCHRANK, 1788, p. 45 [*Tænia articulis conoideis* Bloch renamed].—[?] *Tænia serrata* ROSA, 1794 [not *T. serrata* Goeze, 1782].—*Alyselminthus infundibuliformis* (Goeze) ZEDER, 1800, pp. 271–274.—*Halysis infundibuliformis* (Goeze) ZEDER, 1803, pp. 345–347.—*Drepanidotænia infundibuliformis* (Goeze) RAILLIET, 1893, p. 302.—*Choanotænia infundibuliformis* (Goeze) RAILLIET, 1896, p. 159.—*Choanotænia infundibulum* (Bloch) COHN, 1899c, p. 421.—*Monopylidium infundibuliformis* (Goeze) CLERC, 1903, pp. 354–356, pl. 11, figs. 72, 74–76, 83.

SPECIFIC DIAGNOSIS.—*Choanotænia:* Length, 20 to 200 mm. or more. Head small, rounded or conoidal, about 0.4 mm. wide. Rostellum 65μ to 90μ wide, armed with a single row of 16 to 20 hooks 20μ to 30μ long, with long dorsal root and short ventral root. Suckers prominent, in preserved specimens elongated antero-posteriorly, major diameter up to 250μ. Short unsegmented neck region somewhat narrower than the head. Anterior segments very short, the following funnel shaped, much narrower at their anterior border than at their posterior border, posterior segments 1.5 to 3 mm. wide and nearly as long or somewhat longer, according to state of contraction, with convex lateral borders, and nearly as wide at the anterior border as at the posterior border. Genital pores irregularly alternating, situated one in each segment in the anterior third of the lateral margin, usually under cover of the backward projecting posterior border of the preceding segment. Vas deferens and vagina pass between the excretory canals and dorsal of the nerve.

Male reproductive organs: Testicles 25 to 40, massed in the posterior half of the segment. The vas deferens passes forward and in the anterior third of the segment forms a mass of coils which extends from the median line outward to the base of the cirrus pouch. Cirrus pouch globular, 75μ to 95μ in diameter. The portion of the vas deferens within the cirrus pouch is somewhat coiled. Cirrus 55μ to 70μ long, armed with long spines; outer surface of cirrus pouch forming the base of the deep genital cloaca also armed with spines.

Female reproductive organs: Vaginal opening in the genital cloaca posterior of the cirrus pouch. Vagina lies posterior of the cirrus pouch, and after crossing the ventral excretory canal is dilated to form an elongated seminal receptacle posterior and ventral with respect to the vas deferens, and extending to the well-developed shell gland, 40μ to 50μ in diameter, located at about the middle of the segment. The transversely elongated ovary occupies the anterior portion of the middle field of the segment in front of the testes, extending, when fully developed, nearly to the excretory canals on each side. Posterior of the ovary and shell gland, and ventral of the latter, is the large yolk gland, somewhat elongated transversely, with convex ventral surface and concave dorsal surface. The gravid uterus fills most of the segment, extending beyond the excretory canals on each side.

Eggs oval, with a very thin membrane next the embryo, followed by a rather thick smooth membrane 40μ by 32μ to 45μ by 36μ in diameter, and one or two outer membranes, very thin and wrinkled in preserved material. Diameter of outer membrane 65μ by 40μ to 60μ by 45μ; at each pole of the outer membrane a delicate appendage. Embryonal hooks 18μ long; embryo 32μ by 22μ in diameter.

LIFE HISTORY.—? Intermediate stage in the common house fly.

HOSTS.—Chickens (*Gallus domesticus*) ; migratory quail (*Coturnix coturnix*).

LOCATION.—Small intestine.

GEOGRAPHICAL DISTRIBUTION.—Europe, Africa, North and South America.

Tapeworms from ducks and pigeons have been assigned to this species, but its presence in these hosts is open to question. Cysticer-

coids showing many of the characters of the adult tapeworm head have been found in flies, but it has not been determined experimentally whether or not these cysticercoids represent a stage in the life history.

Davainea tetragona (Molin, 1858) BLANCHARD, 1891.

SYNONYMY.—*Tænia tetragona* MOLIN, 1858, p. 139.—*Davainea tetragona* (Molin) BLANCHARD, 1891t, p. 436, fig. 15 [in part].—*Tænia botrioplitis* Piana of FILIPPI, 1892a, pp. 75–78, pl. 1, figs. 1–4 [misdetermination].—*Tænia bothrioplitis* Piana of FILIPPI, 1892c, pp. 249–294, pls. 1–10 [misdetermination].—*Davainaea tetragona* (Molin) DIAMARE, 1898a, pp. 480–483 [misprint].—[?] *Davainea paraechinobothrida* MAGALHÃES, 1898, pp. 443, 444.

SPECIFIC DIAGNOSIS.—*Davainea:* 10 to 250 mm. long by 1 to 4 mm. broad, these dimensions varying with age and state of contraction. Head 175μ to 350μ in diameter, with retractile rostellum 50μ to 70μ in diameter, armed with a crown of about 100 hooks arranged in a single row. Suckers oval, 50μ to 90μ in diameter, armed with 8 to 10 rows of hooks. Rostellar hooks 6μ to 8μ long through longest axis, hammer shaped, with long ventral root and short dorsal root, prong short and recurved. Acetabular hooks of various sizes, from 3μ to 8μ, measured through longest axis, with long, thorn-like prong, dorsal root very short, ventral root longer than dorsal root, but shorter than prong. Neck usually long and slender. Segments trapezoidal and imbricate, edge of strobila serrate. Ultimate segments usually longer than broad, bell shaped. Genital pores unilateral, situated one in each segment, at or in front of the middle of the lateral margin, frequently marked by a papilla. Male and female canals pass on the dorsal side of the nerve and excretory vessels.

Male genitalia: Testes 20 to 30 in median field surrounding the female glands, most of them lying on the aporose side of the latter. Vas deferens lies in anterior third of segment, begins near the median line, and extends in a much convoluted course laterally to the base of the cirrus pouch, which it enters and, after a few coils in the basal portion of the latter, becomes transformed into the cirrus. Cirrus pouch pyriform, 75μ to 100μ in length. Basal portion surrounded by a prominent layer of longitudinal muscular fibers, neck with a thick layer of transverse fibers. Cirrus without apparent spines.

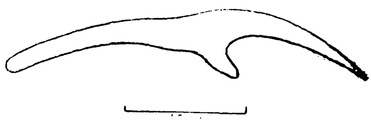
Female genitalia: Ovary in middle of segment. Yolk gland posterior of ovary, irregularly reniform, slightly longer in its transverse axis, about 100μ in diameter. Shell gland prominent, 50μ in diameter, immediately in front of yolk gland. Vagina begins at the genital pore posterior of opening of cirrus pouch, at first very slender but at a distance of 15μ to 25μ swells out into a thin-walled tube, functioning as a seminal receptacle, which extends transversely across the segment and joins the oviduct on the dorsal side of the ovary near the median line. The oviduct, after being joined in the shell gland by the vitelloduct, proceeds forward and ends on the dorsal side of the ovary. A definite and persistent uterus is not developed. The eggs as they pass from the distal end of the oviduct become embedded in a fibrous and granular mass, which gradually fills up most of the segment. This mass divides into 50 to 100 portions to form egg capsules, each surrounded by a membrane and containing 6 to 12 or more eggs. The egg is surrounded by three envelopes—an inner, close to the onchosphere; a middle, folded; and a smooth outer envelope. The onchosphere measures 10μ to 14μ in diameter; the outer envelope from 25μ to 50μ.

LIFE HISTORY.—Unknown.

HOST.—Chickens (*Gallus domesticus*).

GEOGRAPHICAL DISTRIBUTION.—Europe, Asia, North and South America.

Anatomically this worm is very closely related to the next following species, *D. echinobothrida*, but it lacks the peculiar pathological effects of the latter, which produces a nodular disease of the intestine with lesions much resembling those of tuberculosis.



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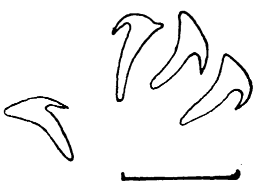

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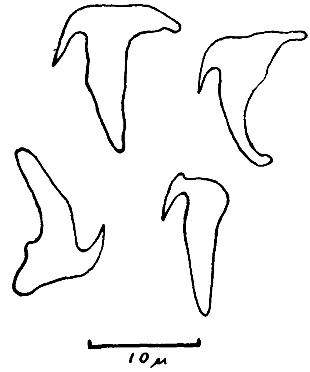

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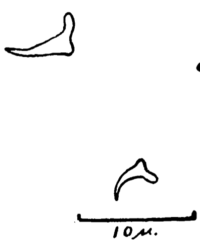

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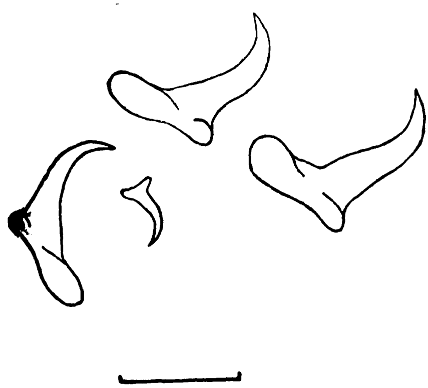

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FIG. 15.—*Choanotænia infundibuliformis*. Hook from rostellum. Enlarged. Original.
FIG. 16.—*Davainea tetragona*. Hooks from rostellum. Enlarged. Original.
FIG. 17.—*Davainea echinobothrida*. Hooks from rostellum. Enlarged. Original.
FIG. 18.—*Davainea cesticillus*. Hook from rostellum. Enlarged. Original.
FIG. 19.—*Davainea tetragona*. Hooks from suckers. Enlarged. Original.
FIG. 20.—*Davainea echinobothrida*. Hooks from suckers. Enlarged. Original.

Davainea echinobothrida (Mégnin, 1880), BLANCHARD, 1891.

SYNONYMY.—*Tænia infundibuliformis* of MÉGNIN, 1880, pp. 395, 396 [in part].—*Tænia echinobothrida* MÉGNIN, 1880, pp. 119, 120.—*Tænia echinobotrida* MÉGNIN, 1881, p. 44 [misprint].—*Tænia botrioplites* PIANA, 1881, pp. 84–85.—*Tænia botrioplitis* PIANA, 1882, pp. 387–395, 1 pl.—*Tænia tetragona* Molin of KRABBE, 1882, pp. 361–362, pl. 2, figs. 55–60 [in part].—*Tænia bothrioplitis* RAILLIET, 1886, p. 267 [orthographic emendation of *T. botrioplitis* Piana].—*Tenia* [sic] *botrioplitis* (Piana) PERRONCITO, 1886, p. 245.—*Davainea echinobothrida* (Mégnin) BLANCHARD, 1891t, p. 433, fig. 9.—*Davainea tetragona* (Molin) of BLANCHARD, 1891t, p. 436, fig. 15 [in part].—*Tænia bothrioplites* BLANCHARD, 1891t, p. 436 [orthographic emendation of *T. botrioplites* Piana].—*Tænia botryoplitis* DOLLEY, 1894a, p. 1013 [misprint].—[*Tænia*] *botriophilitis* SCAGLIOSI, 1896, p. 539 [misprint].—*Davainea bothrioplitis* (Piana) MAGALHÃES, 1898, pp.

442, 443, 444.—[?] *Davainea paraechinobothrida* MAGALHÃES, 1898, pp. 443, 444.—*Tænia tetragona botrioplitis* PERRONCITO [? 1901], p. 268 [as a variety of *T. tetragona* Molin].

SPECIFIC DIAGNOSIS.—*Davainea:* Length, up to 250 mm.; width, 1 to 4 mm. Head, 250μ to 450μ in diameter, with retractile rostellum 100μ to 150μ in diameter, armed with a crown of about 200 hooks arranged in two ranks. Suckers round or oval, 90μ to 200μ in diameter, armed with 8 to 10 rows of hooks. Rostellar hooks similar in type to those of *D. tetragona*, but larger, measuring 10μ to 13μ in length. Acetabular hooks likewise similar to those of *D. tetragona*, but also larger, the largest measuring from 12μ to 15μ over all and the smallest 6μ. Neck generally thicker and shorter than that of *D. tetragona*, frequently equal in width to the head. Strobila resembling that of *tetragona*, but with serrate border more pronounced. Ultimate segments in preserved specimens differ also from those of *tetragona*, being less elongate and frequently marked by a median constriction. Owing to this constriction the adjacent borders of the most posterior segments pull apart in the median line and remain joined only toward the sides, giving rise to a median series of openings through the posterior portion of the strobila. Genital pores irregularly alternate, or sometimes almost entirely unilateral, situated one in each segment posterior of the middle of the lateral margin. Male and female canals pass on the dorsal side of the nerve and excretory vessels.

Male genitalia: Testes 20 to 30, arranged in median field as in *tetragona*. Vas deferens similar to that of *tetragona*. Cirrus pouch flask-shaped, 130μ to 180μ in length. Basal portion globular or ovoid, surrounded by a thick layer (10μ) of longitudinal muscle fibers, inside of which is a thick layer (15μ to 20μ) of transverse fibers. Neck of pouch measures 50μ to 75μ in length by 15μ to 20μ in diameter, surrounded by a layer of transverse fibers, thickened at the distal end of the pouch to form a sphincter. According to Mégnin, the cirrus is armed with minute spines.

Female genitalia.—Female organs as in *D. tetragona*. Eggs similar in size and structure.

LIFE HISTORY.—Unknown. According to Piana (1882) its supposed larva occurs in snails.

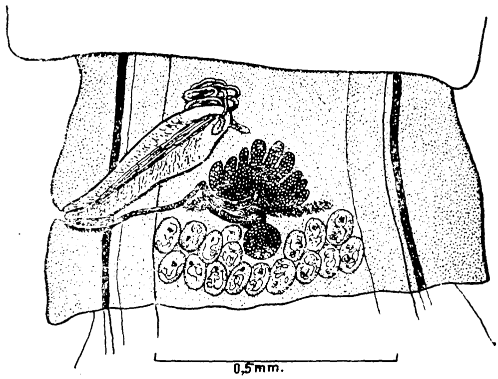
HOST.—Chickens (*Gallus domesticus*).

GEOGRAPHICAL DISTRIBUTION.—Europe, Asia, Africa (Pasquale, 1890), North and South America.

Davainea echinobothrida and the preceding species (*D. tetragona*) have been frequently confused on account of their great similarity in appearance.

D. echinobothrida, however, when fully matured is generally somewhat larger. The head, rostellum, suckers, hooks, and cirrus pouch are larger, the rostellar hooks are more numerous, the neck is shorter and thicker, and the genital pores are usually irregularly alternate, and situated in the posterior portion of the segments, those of *D. tetragona* being unilateral and situated at or in front of the middle of the segments.

An important characteristic of *D. echinobothrida* is the nodular disease of the intestine which it causes, a condition liable to be mistaken for tuberculosis. This disease was first recorded in the United States by Moore (1895), from whose article the following extracts are made.



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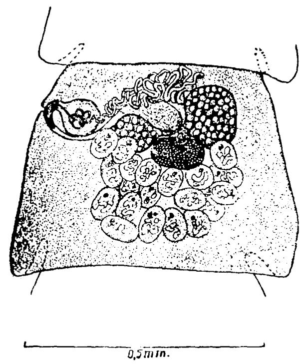

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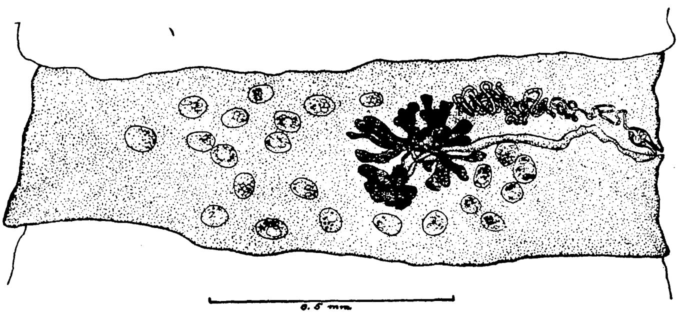

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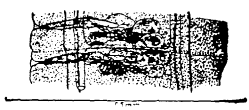

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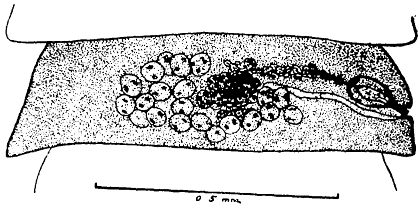

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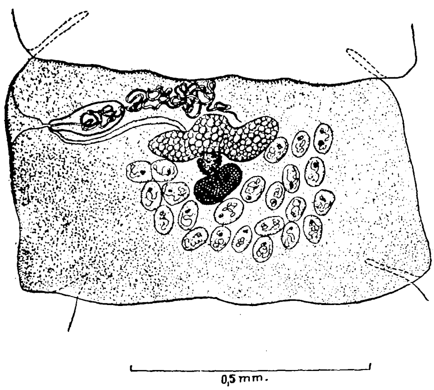

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FIG. 21.—*Metroliasthes lucida.* Segment showing the reproductive organs, ventral excretory canals, and lateral nerves. Enlarged. Original.

FIG. 22.—*Hymenolepis carioca.* Segments showing reproductive organs, excretory canals, and nerves. Enlarged. After Ransom, 1902, pl. 23, fig. 1.

FIG. 23.—*Choanotænia infundibuliformis.* Segment showing reproductive organs. Enlarged. Original.

FIG. 24.—*Davainea tetragona.* Segment showing the reproductive organs. Enlarged. Original.

FIG. 25.—*Davainea echinobothrida.* Segment showing the reproductive organs. Enlarged. Original.

FIG. 26.—*Davainea cesticillus.* Segment showing reproductive organs. Enlarged. Original.

The nodules were invariably more numerous in the lowest third of the small intestine. They occasionally appeared, however, in small numbers in both the duodenum and colon. The larger and to all appearances older nodules were found in the ileum near the ceca.

In the badly affected portion the nodules gave the appearance of closely set protuberances, varying in size from barely perceptible areas of elevation to bodies 4 mm. ($\frac{1}{6}$ inch) in diameter. In some instances they appeared to overlap one another. When separated by a band of normal tissue they were round or somewhat lenticular in form. In the latter case the long diameter was usually transverse to the long axis of the intestine. The larger nodules were of a pale or dark-yellowish color, while the smaller ones varied in shade from the more highly colored areas to the neutral gray of the normal serosa. To the touch they gave the sensation that would be expected if the subserous and muscular coats were closely studded with small, oval, solid bodies. The mucosa presented similar elevations. Attached to the mucosa over the nodules were a number of tapeworms. There were also in the more advanced cases a variable number of small (0.5 to 1 mm.) areas over the larger nodules in which the mucosa had sloughed, leaving small ulcerated depressions.

The larger nodules contained a greenish-yellow necrotic substance, which appeared in the advanced stages as a sequestrum with a roughened surface. On section it has a glistening, homogeneous appearance. Surrounding the necrotic substance was a thin layer of infiltrated tissue. The smaller nodules contained a more purulent-like substance and the smallest appeared to the naked eye as areas of infiltration. Sections of the affected intestine showed upon microscopic examination that the heads of the tapeworms had penetrated the mucous membrane and were situated in different layers of the intestinal wall. They were frequently observed between villi. As would be expected, the heads were not readily detected in the necrotic masses contained in the larger nodules, but were almost invariably seen in the smaller ones. In a few sections the tapeworm could be traced through the mucosa to the nodule in the muscular tissue in which its head appeared. In the earlier stage of the nodular development there is a cell infiltration about the head of the worm. This process continues until the infiltrated tissue reaches a considerable size.

The worms attached to the mucosa were usually small. A larger form was commonly found in the intestinal contents. Although macroscopically they appeared to be different, Doctor Stiles found that they were presumably of the same species.

Economic importance.—The importance of this disease is much greater than it at first appears, as the close resemblance of the nodules to those of tuberculosis renders it of much significance from a differential standpoint. As the intestines are stated to be frequently the seat of the specific lesions of tuberculosis in fowls, it is of the greatest importance that a thorough examination be made before a positive diagnosis is pronounced. There are already several statements concerning the presence of tuberculosis in fowls in which the data given are not sufficient to differentiate the disease from the one here described. A somewhat analogous disease of sheep caused by a nematoid (*Œsophagostoma columbianum* Curtice) has led to the deliberate destruction of many animals, the owners believing that tuberculosis was being eliminated from their flocks.

As the inquiry into the cause of poultry diseases becomes more general it is probable that this affection will be occasionally encountered, and unless its nature is recognized it may in some instances, like the sheep disease, lead to an unwarranted destruction of property.

In addition to its importance in differentiating tuberculosis it is in itself a malady worthy of careful attention. The fact that it has already appeared in

two flocks in the District of Columbia, and also in the States of North Carolina and Virginia, shows that the infesting cestode is quite widely distributed in this country. It is highly probable that the total loss it occasions, both from deaths and from the shrinkage of poultry products, due to the chronic course of the disease it produces, is very large.

DIAGNOSIS.—Tuberculosis is, as before stated, the only known disease for which this affection is liable to be mistaken, and it is of much importance that the two diseases should not be confounded. The diagnosis has not in my experience been difficult, as in every case the attached tapeworms were readily detected upon a close examination of the intestinal contents or of the mucous membrane of the infected portion of the intestine. However, the worms are quite small and could easily be overlooked in a hurried or cursory examination. In case of doubt, if the affected intestine is opened and the mucous surface washed carefully in a gentle stream of water, the small worms will be observed hanging to the mucous membrane. This discovery, in the absence of lesions in the liver or other organs, would warrant the diagnosis of the tapeworm disease. Although much is written concerning tuberculosis in fowls, especially in Europe, the investigations of poultry disease by this Bureau have thus far shown that it is not common among fowls in this country.

Davainea cesticillus (Molin, 1858) BLANCHARD, 1891.

SYNONYMY.—*Tænia infundibuliformis* Goeze of DUJARDIN, 1845, pp. 586–587, pl. 9, fig. A [misdetermination].—*Tænia cesticillus* MOLIN, 1858, p. 139.—*Davainea cesticillus* (Molin) BLANCHARD, 1891t, p. 434, fig. 11.

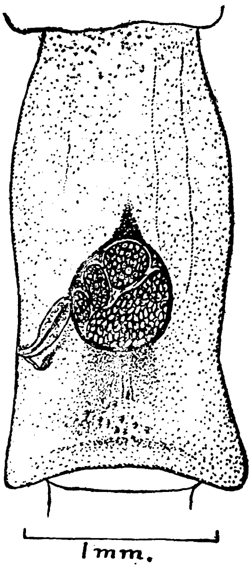
SPECIFIC DIAGNOSIS.—*Davainea:* Length, 10 to 100 mm. Maximum width, 1.5 to 3 mm. Head cylindrical, sometimes spheroidal, 0.3 to 0.6 mm. wide and 0.2 to 0.4 mm. long. Suckers unarmed, about 0.1 mm. in diameter. Rostellum broad and flat or hemispherical, 0.25 to 0.35 mm. wide, armed with a crown of 400 to 500 [a] hooks, which are very instable and easily lost, arranged in two ranks. Hooks 8μ to 10μ long, with short dorsal root and long ventral root. Neck very short. Anterior segments three to five times as broad as long; the following increase in size until they become equal in length and breadth and finally even longer than broad; borders overlapping. Genital pores irregularly alternate, one in each segment, somewhat in front of the middle of the lateral margin in young segments and nearer the middle in older segments. Vagina and cirrus pouch pass dorsal of the two excretory canals and nerve.

Male reproductive organs: Testes, 20 to 30 in the posterior portion of the segment. Vas deferens much coiled before entering the base of the cirrus pouch, also coiled within the latter. Cirrus pouch ellipsoidal, 120μ to 150μ long by 55μ to 70μ wide. Cirrus when protracted, 10μ in diameter, armed with minute spines, and with a bulbous enlargement 20μ in diameter at its base, where it becomes continuous with the cirrus pouch; length when fully protracted, 150μ.

Female reproductive organs: Vagina is enlarged before reaching the median line into a small seminal receptacle. Ovary occupies the middle field in front of the testes. Yolk gland and shell gland posterior of the ovary, ventral and dorsal, respectively, in relative position.

Uterus develops at first in front of the ovary; gradually increasing in size, it finally occupies most of the segment and frequently extends laterally beyond the excretory canals. In the oldest segments it becomes divided into compartments or capsules each containing a single egg. Embryo, 36μ by 27μ in diame-

[a] Other authors state about 200, but apparently have underestimated the number.



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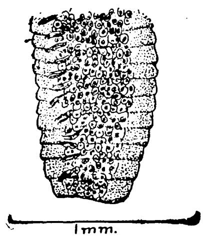

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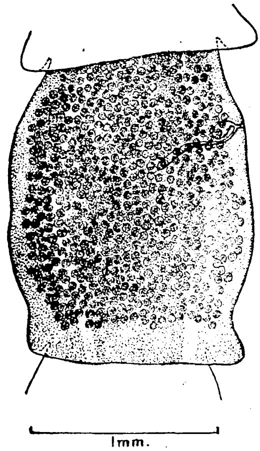

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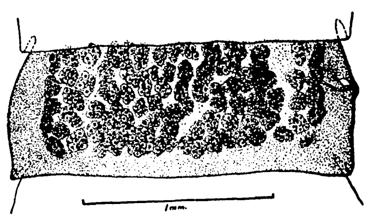
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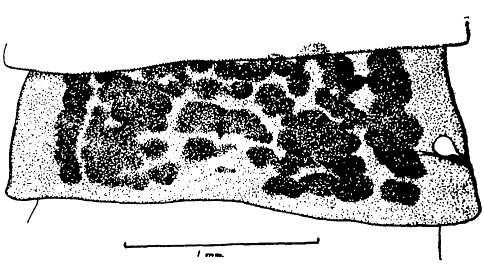
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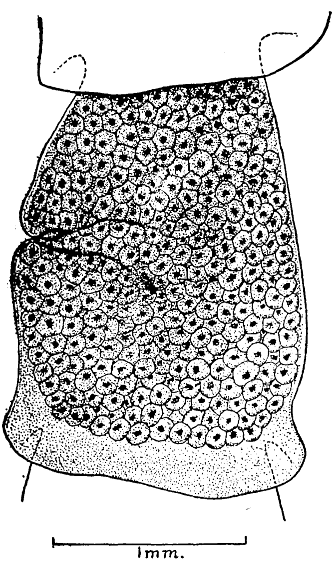

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FIG. 27.—*Metroliasthes lucida.* Gravid segment. Enlarged. After Ransom, 1900, pl. 14, fig. 7.

FIG. 28.—*Hymenolepis carioca.* Gravid segments. Enlarged. After Ransom, 1902, pl. 24, fig. 9.

FIG. 29.—*Choanotænia infundibuliformis.* Gravid segment. Enlarged. Original.

FIG. 30.—*Davainea tetragona.* Gravid segment. Enlarged. Original

FIG. 31.—*Davainea echinobothrida.* Gravid segment. Enlarged. Original.

FIG. 32.—*Davainea cesticillus.* Gravid segment. Enlarged. Original.

ter, with a very thin membrane closely adherent to its surface. The embryo is further enveloped by a thicker smooth membrane, oval in shape, 45μ by 40μ in diameter, with a filament at each pole attaching to a thin outer wrinkled membrane about 65μ by 50μ in diameter, and finally the egg is surrounded by a capsule composed of an outer and inner membrane, the latter closely adherent to or fused with the outer egg membrane and the former more or less widely separated from the latter and connected with it by a number of septa.

LIFE HISTORY.—Unknown.

HOSTS.—Chickens (*Gallus domesticus*), turkeys (*Meleagris gallopavo*).

LOCATION.—Small intestine.

GEOGRAPHICAL DISTRIBUTION.—Europe, Asia, Africa, North and South America.

The principal points among the details given in the diagnosis by which this species may be most readily identified are the head, with its broad, flat rostellum, the width of the most anterior segments usually greater than that of the head, and the eggs distributed in individual egg capsules in the posterior segments of mature worms.

INCUBATION AND INCUBATORS.

By Richard H. Wood, M. D.,
Twining, Mich.

PRELIMINARY REMARKS.

During the past century great progress has been made in nearly all lines of agriculture, and poultry raising, now recognized as an important branch of agriculture, has advanced with other lines. It has become a trade, an art, and a profession. Nor has any other nation made greater progress in poultry raising than has the United States. Poultry raising has been given abundant space in our agricultural journals and place in our leading agricultural colleges.

This article deals entirely and exclusively with the hatching of eggs, or incubation, natural and artificial, and to be complete it must treat of both the egg itself and the means employed in hatching.

Many farmers regard the incubator proposition as one out of their line of study and practice. To them natural incubation is too simple to demand consideration and artificial incubation is too complicated for anyone but an expert. To bring the farmer into closer sympathy with this article it may be well to state that the writer has taken a great and active interest in the subject of incubation for the past thirty years; and, while he has been successful, he has made some failures and met with some disappointments, just as others have done and as many will do until by study and practice they acquire that skill which after all is fully as necessary to success in other lines as in this.

IMPORTANCE OF THE INCUBATOR.

Poultry raising is one of the important features of farm work. The incubator is an important factor in poultry raising. It is a success; it has come to stay; and the time is not far distant when it will be as necessary upon every farm as is the plow, the mower, or the separator. It is a machine the operation of which is simple. It calls for no hard or heavy manual labor. A woman, a child, or even a crippled or invalid member of the household may learn to operate an incubator easily and successfully. To make this possible and to bring a practical knowledge of this subject to every farmer or other interested person in our land, is the aim of this article.

In order to make this article of the greatest value to all, it must appeal to the manufacturers of incubators as well as to the users of them. Hundreds of most excellent incubators are being made and sold, but they are forced to compete with almost as many that are inferior and imperfect if not positively defective. Now, every imperfect machine put out is a serious damage to the incubator business. The purchaser of an inferior machine, failing to secure good results, sets aside his incubator and informs his neighbors that artificial incubation is a failure. On the other hand, the purchaser of a good machine—one properly made and adapted to its work—is so apt to be pleased with his success that he encourages his friends and neighbors to undertake raising chickens with incubators. At this point it seems proper to answer the question, asked so frequently, "Is there not some danger that so many will embark in this business that it will be overdone, and the markets be overcrowded with poultry and eggs?" Answer: No; the demand is constantly increasing, and more production will be followed by increased consumption. As fast as a regular supply can be depended upon, to the same extent will consumers learn to avail themselves of that supply.

Again, not everyone who has gone into the poultry business will remain in it. Many will not find it to their liking, while others will not have sufficient energy and persistence to learn its details. The poultry business is one of the most stable lines of business in the world to-day. Its products are always in demand in every town and city in the world. No prejudice of religion or caste stands in its way. Sales are not limited as to locality or season. When the use of the incubator becomes known, when common farmers become acquainted with its management and its many advantages, then will the public learn that the supply of poultry products is regular, and then will the use of these products be greatly increased.

A STUDY OF EGGS FOR INCUBATION.

First in order, then, comes the study of the egg itself. The writer does not propose to enter into an essay upon embryology. It will be sufficient for our purpose to say that the egg must be fertile, or hatchable, and this brings us at once to the subject of fertility.

An egg receives its fertility from the male bird, but the condition of the female at the time of laying has much to do with the hatching quality of the egg. This should not be regarded as a statement of a far-fetched notion, but as a fact that has been noted and demonstrated time and time again in the writer's own experience. The laying hen must be healthy and properly fed or she can not produce an egg capable of carrying the germ to a successful hatch. Hens kept in unhealthful quarters or too closely confined are not likely to lay eggs

that will produce strong, healthy chickens, if indeed they produce any whatever. Hens suffering from disease or infested with vermin may lay, but eggs from such hens will rarely hatch, and even if they do so the chicks will not be likely to mature into vigorous or growthy fowls. Hence in order to secure hatchable eggs the hens must be healthy, have plenty of outdoor exercise, and be fed upon an assorted or balanced ration. An exclusive corn diet will not make for fertility. Fowls in confinement must have a mixed diet and plenty of grit and bone, with meats, clovers, or other substances in the line of nitrogenous food. They must be kept free from lice and must have plenty of litter, straw, hay, chaff, or leaves in which to scratch. Fowls having free runs need less attention to diet and are more apt to lay fertile eggs than fowls closely imprisoned. Many different ideas prevail as to the number of hens that should be allowed to a cock. In this matter much depends upon the breed of fowls, much depends upon the way the fowls are kept, and much depends upon their ages and condition. One should exercise some oversight as to the matings of his fowls and regulate the size of his breeding pens accordingly. With most breeds we get a larger percentage of fertile eggs from a mating of a number from ten to twelve hens to one cock. Eggs may be fairly safe from a pen of twenty hens with one good, vigorous, young male bird. Some advise keeping but two or three hens with a cock, but in the writer's experience such matings are generally unsatisfactory. The male will so worry and annoy his small flock that but few eggs will be produced and few of them will be fertile. Besides this, two or three hens confined in this way are apt to become jealous, nervous, and quarrelsome. The same cock, if given a larger flock, will keep them harmonious and contented. With these ideas in mind it is safe to recommend that a breeding pen shall consist of from seven to fifteen hens and one cock, and the latter should be strongly bred, in good health, and known to be vigorous. But some recommend keeping more than one male bird in a flock. This may do, but where this is done it is wise to have a comfortable and convenient coop in which to keep one of the cocks, and then by a system of catching up one cock and releasing the other every night give each one alternately a day of rest or a day upon the walk. Another advantage in this system is that the cock has a chance to feed by himself part of the time and can be kept in a more thrifty and vigorous condition than if upon the walk all of the time.

It is highly necessary that the amateur or the novice shall be impressed with the fact that the fowls from which eggs are saved for hatching must be strictly healthy, must have a reasonable amount of exercise in the open air, besides an abundance of strictly fresh and pure water, and a great variety of wholesome food. Even under

the most favorable circumstances the eggs will vary to the extent that there is room for selection. Select eggs of a medium size and an average as to color and shape. Let the selection be influenced by the average product of the hen or breed. An unusually large egg for the breed or hen may be a monstrosity and can not be expected to hatch. An unusually small egg may be defective and should not be incubated. An egg of unusual length or one of unusual rotundity should not be placed under a hen nor in an incubator. An even, uniform lot, assorted as to size, color, and shape, will be apt to give the best results. Freshness is a prime necessity. While an egg six weeks old may hatch, the chick will be weak and hard to raise. Fresh eggs hatch earlier, and the chicks from them are stronger than those from older eggs. As a rule, eggs more than twelve days old should not be placed in an incubator. This is one of the reasons why eggs from a flock numbering from ten to twelve hens are more apt to hatch than are eggs from a flock of only three or four hens. They do not have to be stored so long before getting a sufficient number for a setting. Eggs for hatching should be clean; if not clean they should be washed in tepid water and carefully dried with a clean, soft cloth. This washing does not injure the egg, but it must be done quickly and carefully, or the jarring of the contents may ruin it for hatching. As fast as the eggs are washed and dried they should be covered with a layer of clean cloth or absorbent cotton to prevent their becoming chilled. It is good practice to stand the eggs in a cool quiet place, each with the large end uppermost, for a period of twelve hours before placing for incubation. This balances the yolk in the center and locates the air cell.

In this connection it is well to bear in mind that eggs laid the day they are set will hatch several hours earlier than those that are a week older.

Eggs waiting for incubation should be kept at a temperature of about 60° F., although they will stand a variation of temperature from 40° to 100° F. They should not be allowed to dry out, nor should they be exposed to a current of cold air, steam, or vapor. During storage, eggs for incubator use should be partly turned every day. A little attention to these simple directions will make quite a difference in the possibilities of fertile eggs and will greatly augment the percentage of chicks.

It is poor practice to set eggs of more than one kind or breed together in the same machine, for eggs of different kinds vary in thickness and strength of shell and in the amount of heat and moisture required.

So much, then, for the subject of fertility, all of which can be summarized in the following brief maxims: The breeding stock must be

healthy and properly fed, watered, and exercised. Eggs must be carefully and promptly gathered and cared for. The egg has as much to do with the result of incubation as has the incubator. The machine should not be blamed for failing to hatch a defective egg.

INCUBATION.

The history of incubation is rather obscure. Natural incubation, which is dependent upon the instinct of the mother hen, seems to be conducted by the modern hen in just about the same manner as that of the barnyard fowl of fifty or more years ago. Artificial incubation, or hatching by machinery, is known to be an old idea, and yet very little information upon original processes is to be found in our libraries. Eggs were hatched by artificial means centuries ago. Machines were invented and used successfully for this purpose by the Egyptians long before the Christian era. Very recently some of these hatching ovens have been found by explorers. Some of them depended upon the customary fuel for their supply of heat, while others relied upon stones heated in the sun, and some, even, were found that obtained the necessary heat from lamps. Besides the above sources of incubation heat, mention can be made of decomposing animal and vegetable matter used long ago with unknown success. Not many winters ago the writer had the pleasure of forking out a live and healthy chicken from a heap of compost near the door of his stable. Numerous other instances of accidental incubation have been related, and man's ingenuity has been exercised to devise machines and methods that will insure the transition of the dormant egg into the living chick.

The whole theory of incubation is based upon the fact that, if a fertile egg is kept for a sufficient period of time under certain conditions of heat, moisture, and position, it will be transformed into a healthy fowl.

The period of incubation varies with different species of fowls. The average period of natural incubation is a little over twenty, or about twenty-one days, for the egg of the common hen. This period may be somewhat shortened or prolonged by variations in the conduct of the mother hen, and possibly by changes in the weather. Should the weather be moderate and the hen quiet and faithful, we need not be surprised if the eggs are all hatched by the close of the twentieth or even the nineteenth day. Again, if the weather be extreme or the hen restless and neglectful, we need not look for all the eggs to hatch until the close of the twenty-first or the beginning of the twenty-second day. The same applies to eggs from other fowls, except, of course, that each has its own period of incubation,

subject to the variations mentioned. The following table is accepted by most poultry men and writers upon natural history and is approximately correct:

Period of incubation.

Name of fowl.	Days.	Name of fowl.	Days.
Common hen	21	Goose	30
Pheasant	25	Partridge	24
Duck, common	28	Duck, Barbary	30
Peafowl	28	Turkey	28
Guinea	25		

In spite of all notions to the contrary, the process of hatching can be suspended and held in check for several days without total destruction of the germ. This fact is of practical importance and, if remembered, may save the breeder a good hatch when, because of some accident or oversight, a lot of eggs has been left without outside heat and allowed to cool. Such eggs, if placed at a proper temperature, may hatch fairly well, provided this temperature is maintained a few days longer than the usual period of incubation. The writer has known hatching to be delayed to the twenty-second and, in one instance, until the twenty-fourth day by accidents to his incubators. Hence, where accidents of this kind occur it is wise to keep the eggs warm a day or two overtime, with the expectation that, while incubation may be delayed, the germ is still alive and will develop. This brings to mind one of the greatest advantages of the incubator to the farmer or the farmer's wife—to people who are accustomed to rely upon the mother hen and prefer to raise chickens by natural incubation. Many times the hen will get sick, will die, or without any apparent excuse will leave the nest, and unless another hen is ready to take her place the eggs will spoil. A small incubator in the house will be found useful upon such occasions. The eggs can be removed from the nest and placed in the warm incubator and hatched or kept there until another hen is ready to take up the work. For this purpose alone an incubator is worth its price to any farmer who raises poultry. Many times has the writer saved valuable clutches of eggs by the use of one of these machines when it was found some perverse hen had deliberately abandoned her nest.

THE INCUBATOR.

The egg, its fertility, and period of incubation being now disposed of, the next item for consideration is the machine used in artificial hatching, or the incubator. There are so many different kinds of machines used in hatching eggs that a description of all of them is

quite impossible in an article of this kind. At the present time they are all constructed upon similar principles and along the same lines, and nearly all of them derive their heat from lamps that burn kerosene. In some of the hot-air machines the heat is applied through the medium of heated air, while in others—the hot-water machines—the eggs are supplied with heat from pipes filled with hot water.

THE HOT-AIR INCUBATOR.

In the hot-air incubator a common kerosene lamp is used to furnish the current of hot air which passes over and around the egg chamber and which keeps the eggs at the proper temperature for hatching. Like the hot-water machine, it is supplied with a regulator, which, acting upon a valve or damper, regulates the admission of heat to the egg chamber.

THE HOT-WATER INCUBATOR.

In this incubator water is heated and forced through metal tubes over the eggs, thus distributing heat throughout the egg chamber. It is supplied with a regulator which works upon the same principle as does that of the hot-air machine.

A CONSIDERATION OF THE PARTS OF AN INCUBATOR.

The selection of the lamp is so important that the writer deems it his duty to warn all poultry men against buying a poor lamp. Manufacturers, as well as purchasers, should remember that while the lamp is half the incubator the burner is half the lamp.

The reservoir of the lamp.—Some remarks on the different parts of an incubator are now in order. First, let us consider the lamp, which is the primary source of heat in both hot-air and hot-water machines. Many kinds of lamps have been tried and many patents have been granted upon lamps and parts thereof for incubator use, but the tendency is to discard all that are in any manner complicated and to return to the plain, old-fashioned burner and chimney. The oil reservoir should be made of metal, either copper or galvanized iron, as those made of glass are too liable to break and are too heavy to handle conveniently. This reservoir should have a flat bottom and a flat top. It should have a capacity exceeding the twenty-four hours' demand of the machine. This is very important, for sometimes it happens that the operator is detained for some reason and can not reach his machine at the proper hour, and in such a case the lamp must contain oil enough for a few hours overtime. This reservoir should be plain and smooth outside and inside. It should be well made and well finished, having no rough projections or slivers of metal or solder to catch the hands, the clothing, or the cleaning cloths. Attached to

this reservoir, or body of the lamp, should be a good, strong handle large enough for the hand of the operator. Better no handle at all than one that is slender, sharp-edged, flimsily attached, or too small for the use of more than one or two fingers. Select a lamp with a handle that is broad, strong, smooth, and firmly attached. The lamp is for use, and it should be built to stand handling. It must be strong in order that it may be convenient.

The burner.—The burner is the very important part of an incubator lamp. It should be made with the greatest regard to stability and accuracy. The flat-wick tube is the most common, and, when the burner is properly constructed, it answers every purpose. But many manufacturers are careless about the quality of their burners, and are sending out flimsy and poorly made articles that are difficult to manipulate and are imperfect in action. A little carelessness in selecting a burner has led to the condemnation of many a good incubator. The burner should be made of good material, such as brass or copper, and never of poor material, such as iron or plated tin. The wheel or lever used in raising and lowering the wick must be stout, large enough for its purpose, easy to find, and must turn exactly and easily. Never waste any time upon a burner that does not work promptly and readily, so far as the wick is concerned. If it turns hard, or does not turn to the thirty-second of an inch, it is useless and will cause trouble.

The tube holding the wick should be strongly made of material that will not break, spring, or bend, and it should be so adjusted to the size of the wicks furnished with the outfit that the wick can pass up and down freely without pinching or binding. On the other hand, it should not be so large or loose as to allow the escape of gas along the side of the wick. In one case the pinching of the wick will interfere with capillary attraction, and in the other the looseness of the wick will cause an uncertain or unsteady flame. The wick tube should be perfectly true and smooth across the top. A rough edge with notches, depressions, or projections of metal or brazing will make it difficult to trim the wick; and a poorly trimmed wick gives off an uncertain degree of heat. Alongside the wick should be a small tube for the escape of surplus gas or vapors from the reservoir, but this tube must never project above or even to the top of the wick tube, for if it does it will interfere with trimming and be likely to fill with cinder or soot.

Herewith (fig. 33) is an illustration of a burner that is well constructed and has given excellent satisfaction.

The space under the wick screen should be wide open. The hinge to the cap should be very strong and work freely to the fullest extent. The snap, or catch, to the cap should have proper strength and ten-

sion, and should fasten the wick cap firmly to the burner. Every detail should be examined before the burner is sold. The following questions should be settled before the lamp is packed for shipment: Does it leak? Does it fit? Does the elevator turn easily and accurately? Is the wick tube perfect? Is the top of the wick tube level and smooth? Can the wick be trimmed nicely? Has the burner a chimney that has been made to fit? Does the screw or snap that fastens the chimney work easily and properly? Does the thread of the burner fit the thread in the socket of the lamp? This last question may seem unnecessary, but the writer has purchased incubators having burners which could not be turned into the lamp. All these little matters count and have much to do with the success or failure of the hatch.

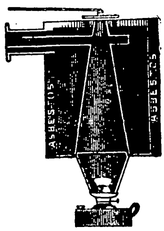


FIG. 33.—Sectional view of a good lamp.

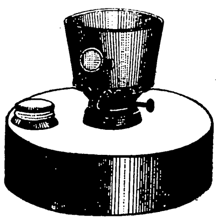


FIG. 34.—One of the best chimneys.

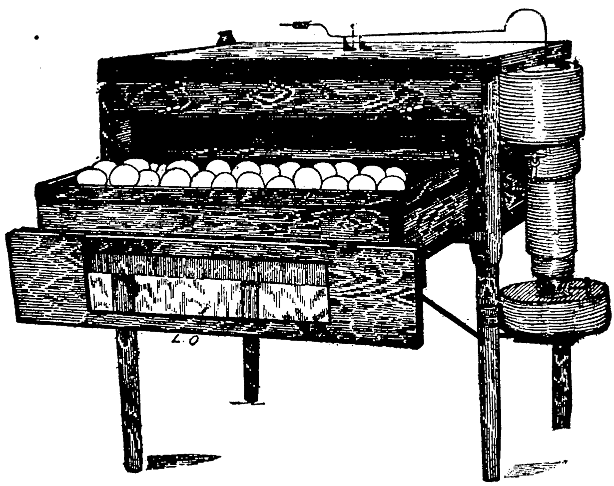


FIG. 35.—A good lamp in position.

While some of the imperfections of a lamp are visible, others can not be discovered until an attempt is made to use the lamp in heating an incubator, or to clean, trim, and fill it. Fig. 33 shows a good lamp.

The chimney.—The chimneys of different makes of incubators vary greatly in form. Few are well made, whatever their shape. The base or lower circumference should be smooth and level. The spiral or bevel of conical chimneys should be so cut that the chimney stands plumb when on the lamp. The top circumference should be smooth and without slivers upon the edge to cut the hands or catch the cloth in cleaning. The mica front should be large enough to show the full width and height of the flame, and this mica should be fastened neatly and securely. Allowance should be made for contraction and expansion. Referring again to the forms of chimneys, the writer

has derived most satisfaction from those of a cylindrical outline. They are preferred to those of a conical outline, although those of the inverted-cone form are convenient to handle and, because of their wide, open tops and short canal, very easy to clean. Fig. 34 is an illustration of a most excellent chimney.

Nearly every incubator catalogue describes its lamp in glowing terms, but a large number of the lamps sold are useless and discredit their manufacturers. It would cost but little more to make them better, and, if they were properly inspected and tested before shipment, it would hardly be necessary to devote so much space to this subject.

The wick.—Nothing has been found yet that takes the place of the plain cotton wick. Other materials have been tried in the so-called "wickless machines," but while wicks of these new materials are more durable than cotton, they need about the same attention in cleaning if not in trimming. The wick should be of medium weave and some firmness and be made to fit the burner in which it is to be used.

The body of the incubator.—The body of an incubator should be mounted upon good strong legs and at a reasonable height from the floor. If too high or too low, the machine is very inconvenient to operate. The writer prefers that the top of the incubator be about 36 inches from the floor. Manufacturers of incubators should remember that these machines are moved about and are sometimes required to carry weight, and they should furnish them with legs for utility rather than for ornament. The body of an incubator should be made of nonshrinkable material and should be air-tight and have well-fitted joints. None but the very best of workmen should be allowed to work upon an incubator. More depends upon a good carpenter than upon a good painter, and the value of any incubator lies, not in how well does it look, but in how well it is made. The walls of the body should be three in number, making two air spaces, and each of these three walls should be well constructed and with good tight joints. If each of these walls is not tightly made, then the manufacturer should not boast of his air spaces, for an open space can not be called an air space. The outside surface of the body should be of smooth finish. Seams, fluting, beadwork, and unnecessary ornamentation should be avoided. It is easy to see how vermin can infest an incubator that is made of beaded matching. The top of an incubator should be smooth and unincumbered. It is useful as a work table in testing, cooling, or turning eggs, and it should be a clear, free surface. It is quite an inconvenience to have part of the regulator upon the top of the machine. A good feature of some incubators is that they have the regulator either at the end of the machine or under cover, if at the top of the table.

The inside of an incubator, or the space known as the egg chamber, should be well finished. No bad joints and no slivers or other evidences of bad workmanship are allowable. The trays should be smooth, well made, and should slide easily upon the tracks. If the trays stick or hang when being drawn out or pushed in, the machine is defective and should not be accepted by the purchaser. Such a defect will not cause loss of time and patience merely, but it may cause the loss of a trayful of eggs. The space called the "egg chamber" should be deep enough from above downward, or, as carpenters express it, "high enough between joints," that the trays and eggs have plenty of space, and so that when necessary the hand or thermometer can be passed back over the eggs. This is important. There should be at least 3½ inches space between the top of the eggs and the heating tank. Convenience and evenness of temperature both demand that the top of the eggs should not be too near the source of heat. Besides this point, the air around the eggs will be better because of this space.

The nursery, or chick, space below the trays should be ample. From the bottom of the tray to the floor of the nursery should be a space of nearly 4 inches. This space will give the chicks in the nursery a chance to stand erect and also allow the trays to be moved in or out without danger to the youngsters below. One of our best incubators is faulty in this respect, and, while it is a very successful hatcher, it decapitates or otherwise injures several of the chicks every time the tray is drawn out or replaced. Better no space below than a space that is too limited. The removable nursery is one of the most valuable improvements that has been made in incubator attachments for many years, and all who have used it agree that no machine is complete without it. It gives an abundance of room for the chicks as they drop from the tray above and it permits the removal of the chicks from the nursery without disturbing any unhatched eggs that may be left in the tray. The bottom of the nursery is covered with a canvas carpet so that the chicks will not be lamed or injured by slipping. The floor of the removable nursery is usually attached to the front of the egg chamber at right angles and in such a way that the whole nursery can be drawn out as easily as one usually pulls out the drawer of his desk. Such an arrangement makes cleaning and inspection easy, besides giving one access to the chicks in cases of partial or delayed hatches. It also makes it possible to use the nursery to its greatest advantage. The first twenty-four hours are very important ones in the life of a chick, and a properly constructed removable nursery is the best place that has been found for its safety and welfare. The illustration (fig. 36) represents a movable nursery.

Although allusion has been made in the preceding lines to the tray, still a few more words seem necessary before passing the subject. The tray should be strongly made of well-dressed material well put together. It should not spring nor sag when loaded with eggs. It should be made of soft wood, and the nails and screws used should be long enough to hold the parts firmly together. A flimsy or poorly made tray is to be avoided. It means loss of time and loss of eggs by breaking. The writer once bought an incubator the trays of which were put together with carpet tacks and screws too short to hold the different parts in position. The attempt to use was accompanied by the loss of nearly a trayful of eggs, and he hopes that his readers will profit by his experience and examine all trays carefully before

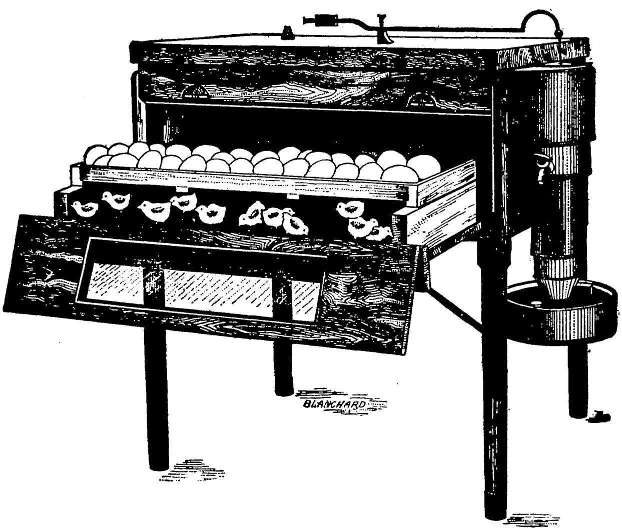


FIG. 36.—Showing removable chick tray and nursery—an indispensable adjunct.

setting up a new incubator. Many trays are partitioned by wire into small spaces, each capable of holding five or six eggs. As a rule such trays are unsatisfactory. A simple division by three-cornered wooden strips into transverse rows or ranks is highly satisfactory, and it is preferable to any other form of tray. The edged strips of wood stiffen the tray without encumbering it, they take up no egg room, and do not interfere with the process of turning. The tray must not be allowed to slide all the way back against the wall of the egg chamber. A space of at least $2\frac{1}{2}$ inches should be allowed between the tray and the back wall of the machine. A block should be fastened to the top of the track at its farther end to prevent the operator from forcing the tray back and closing up this space. This is important, as the chicks are apt to be pinched, crippled, or killed if the tray

can be pushed too far back. A similar space should be allowed between the front edge of the egg tray and the door. The chick needs this space when it drops from the tray to the nursery.

Returning to our consideration of the body of the incubator, much can be said about the arrangement of the door, or hinged window, in front. Select a machine with a double-glass door. The two layers of glass must have 1 inch of space between them so that they can be cleaned. Many manufacturers are careless about the fit of the door. It should open and close easily, but snugly. If it does not open and close easily, one is liable to jar the eggs and disturb the level of the incubator. The sash of the door should be heavy enough for strength, but not so wide as to interfere with the view of the eggs or the thermometer. The glass in the door should be wide enough in the perpendicular to afford the operator a full view of the egg chamber without stooping or kneeling. It is not a view of the wooden edge of the tray that the operator wants; it is a view of the thermometer, the eggs, or the chicks. The glass should be located so as to permit this view, but if the glass is too narrow or not properly placed, or if the

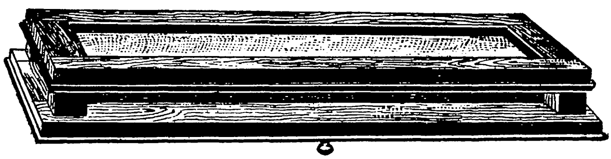


FIG. 37.—An up-to-date door.

margin of the sash is too wide, the window will be of little value to the operator. This matter is worthy the attention of the manufacturer, for there is quite a prejudice against a machine the temperature of which can not be watched without the removal of the thermometer from it. Many manufacturers send machines with doors imperfectly fitted, the glass of which is covered with paint, putty, or varnish, which can not be removed, and it is impossible to read the thermometer through such doors. Once more purchasers are warned to avoid the machine that will not permit them to read the thermometer without opening the door. Manufacturers should bear in mind that the light should strike the egg tray from above instead of from below.

The thermometer.—It is really surprising that up to the present time so little improvement has been made in thermometers. An instrument of this kind should be plainly legible and it should be convenient to handle. The usual practice of glazing the back of the tube with white porcelain makes the reading of the temperature very difficult. There seems to be no good reason for this. This white background makes a grayish shade, the color of the mercurial column, and unless the light is very good and strikes the figures from

the right direction it is almost impossible to ascertain the temperature without removing the thermometer from the machine. This is bad, as the column is likely to contract or expand while being conveyed to the light. The column should be large enough to be seen from a distance of at least 4 feet, and the markings and figures should be few and very plain. Many of the frames in which the glass is set are cumbersome, take up too much room, obscure the view, have sharp corners or long legs to catch upon the tray or sleeve, and yet are too unstable to stand alone or stay where placed. A thermometer with a red or green background, a large mercurial column, a few plain marks and figures, and mounted upon a convenient yet substantial frame will be a boon to poultry men. Improvements will be made, and it is well for purchasers to ask for the latest and the best. In connection with thermometers it is well to state that the so-called "magnifying lens" is a failure and much more difficult to read than the plain round tube unless it is held in exactly a certain position with reference to the light. The thermometer tube need not be over 4 inches long, and the less metal it has attached to it the better. In regard to the accuracy of the thermometer, almost any physician will test it for you by the side of his clinical thermometer, which has about the same scale and range.

The regulator.—Many are the methods that have been tried for automatically regulating the temperature of the egg chamber. So far all of them depend upon the principle of contraction and expansion. The demand is for some simple device that will allow the temperature to rise so high and no higher, and that will maintain the temperature at that degree regardless of the weather or external influences. Most regulators act upon a damper over the top of the lamp, and, by opening or closing the same, regulate the amount of heat that passes into the incubator. The expanding horseshoe-shaped bar, the elliptical spring bar, and the metallic disk are the most common regulator powers of the present. Perhaps in the course of time some one will make a regulator from a coil or spiral spring that, reaching clear across the top of the egg chamber, will very accurately control the admission of heat.

At the present time the best regulator is the double disk, whether filled with air or with liquid. Excellent results are obtained by using the single disk, but the double disk is still better. The disk, in order to be useful, should be large enough to have some force and to note the slightest variation in temperature. A disk of only 1 or 2 inches diameter has hardly power enough, nor is it delicate enough for quick and perfect action. The writer prefers the double disk and that with a diameter of 4 or 5 inches. Such disks will be very susceptible to changes in temperature and will be strong enough to act

upon the damper. Of course there are machines that use the horseshoe or buggy spring expanding bar, which work fairly well; but as fast as possible the writer has these attachments removed and the disk substituted for them. Many purchasers have no patience with a regulator that will not work from the start, and, owing to the fact that first impressions are prejudicial, it is safer to ship articles that will go together readily and work from the start. There is something in the location of the regulator. The disk should be placed near the center and well toward the back of the egg chamber. It should be placed so high that it is not in the way of the eggs or the tray. Another reason for placing the disk high is that, because the chicks as they hatch will tumble around more or less before dropping into the nursery, one or more of them may hit the regulator, thus disturbing its adjustment and bringing disaster to the remainder of the hatch. The regulator should be strongly fixed in its bearings, so that an accidental touch will not put it out of order.

Most machines have the long bar or damper lever upon the top of the body. This is a serious fault. The top of the machine is the most convenient table for cooling, testing, or turning eggs, and it should be free and clean for that use. Besides this, the lever, when located outside and upon the top of the machine, is easily affected by a current of air and also liable to become bent or dislocated. A child, a stray fowl, a mouse, a cat, or a slight breeze will be likely to interfere with the action of the regulator if it is exposed upon the top of the incubator. Some makes of incubators have the damper lever at the end of the case; others have it above the egg chamber, where it is covered and protected. The adjustment of the regulator should be perfect and accurate. Threads should be true and cut to fit the bur; rods should be of proper length and, if weights are used, they should be so arranged that they can be fixed in the proper position. The writer sees no use for the weight, nor does he favor a very long lever. By principle of direct action the damper is its own weight, and with the disk regulator no other weight seems necessary. In some machines the regulator is cumbersome, takes too much space in the egg chamber, and interferes with the handling of the trays; in others it is loosely set and constantly getting out of balance and dropping down upon the eggs or chicks. The disk regulator is less in the way and less liable to fall down than any other that the writer has used. Figure 38 shows a good regulator.

Few machines are perfect in all their parts, but when one is found that suits in most details it is kept and remodeled to suit everyday requirements. Most manufacturers make a mistake in their failure to test every machine as a whole before sending it out. Made of the same materials, from the same patterns, by the same machinery and the same workmen, all mechanical products are liable to vary some-

what in their action. Each incubator has an individuality, and it requires a thorough test at the factory.

The purchaser can feel assured that plenty of incubators are now made by firms that test them in the shops and whose regulators can be relied upon as surely as can a watch or clock. Defects have been mentioned for the good of both manufacturers and purchasers, as the author firmly believes the incubator to be a staple article of manufacture and use, and a money maker for the intelligent and persistent operator.

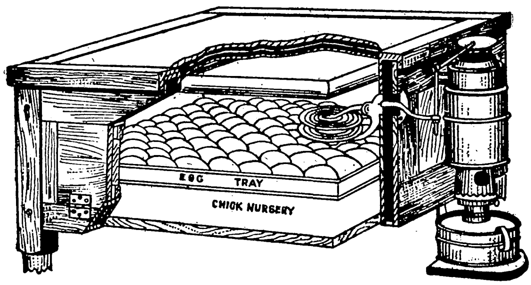


FIG. 38.—A good regulator.

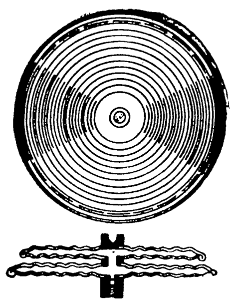


FIG. 39.—Thermostat—front and sectional view.

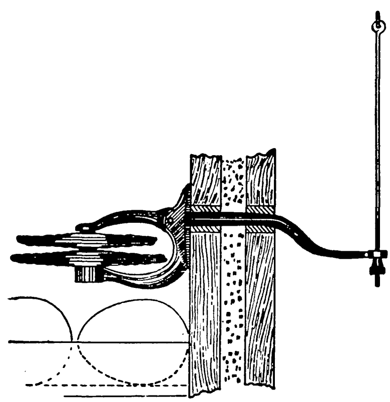


FIG. 40.—Thermostat—side and sectional view.

Ventilation.—So much has been written upon the subject of ventilation that the reader need not expect the writer to add much that is new to the literature upon this subject. One thing is sure, namely, that in nature the mother hen is compelled to allow fresh air access to her eggs. But she frequently makes her nest in places where the air is far from good, and yet she gives us a fair hatch regardless of atmospheric surroundings. It is not likely that frequent currents of fresh air over the eggs are necessary to successful incubation, nor does it seem certain that air in motion, even if it has been warmed, is inclined to promote hatching. If the machine is opened twice a day and the eggs taken out to be cooled or turned, they get about

all the ventilation they really need. But accidents may happen; there may be leaking of steam or smoke, or a breaking of an overlooked decomposing egg, and, for fear that such an accident may happen between the hours of inspection, it is well to have a system of moderate ventilation in operation. One of the best methods is a circular hole in the bottom of the machine, this hole being about 1½ inches in diameter and covered with fine wire screening on the inside and provided with a slide of tin or other metal upon the bottom or outside. This slide should be open when the machine is first heated. It should work easily and be slightly open all the time, and should be altered according to the weather. One thing often overlooked is the quality of the air in the room occupied by the incubator. The room should be clean, free from dust and mold, moderately dry, and contain air of absolute purity. This has more to do with the condition of the air in the egg chamber than many are inclined to admit, and is, in the writer's opinion, the major part of ventilation.

Moisture.—This is another topic that has been freely discussed in the poultry journals. A great many different plans have been advocated for keeping the air in the egg chamber properly charged with water. The simple plan of placing in the bottom of the egg chamber a saucer containing a small wet sponge is as good as any. There does not appear to be any better method than this of rendering the air around the eggs humid. The amount of moisture required is so little and varies so much under different circumstances that the ingenuity and judgment of most operators can be relied upon to provide moisture as needed. If the incubator is operated in a cellar or basement, the air will probably be damp enough without the further introduction of moisture into the egg chamber.

A SUMMARY OF THE DEFECTS OF INCUBATORS.

The following summary of faults most frequently found is here appended: Poor material, poor workmanship, and poor arrangement are all to be condemned. Machines of poor construction, or constructed out of refuse material from other lines of manufacture, will no longer satisfy the up-to-date poultry man. Incubators made out of the odds and ends of other goods, or with coarse, dull tools, are no longer in demand. Machines made by men who know nothing about the poultry business, or who take no interest in that business and lack experience in operating incubators, are likely to prejudice the public against the use of all incubators. The inspector should be competent. If he does not know how to test every part of a machine and exercise thoroughness in his work, one can hardly expect the output of his factory to give satisfaction.

A SUMMARY OF THE GOOD POINTS OF AN INCUBATOR.

On the other hand, good material, good workmanship, and adaptability of parts, or such arrangement of the various parts of the machine as shall make it efficient, practical, and convenient, are desirable. Two dead-air spaces, good strong legs, plenty of space in the egg chamber, good windows properly placed, a good thermometer located where it can be read without disturbing the machine are all necessary and among the strong points of a good incubator. In addition to these, there are a good lamp—one with a good burner and good chimney—a good regulator, a good strong tray properly placed, and a good

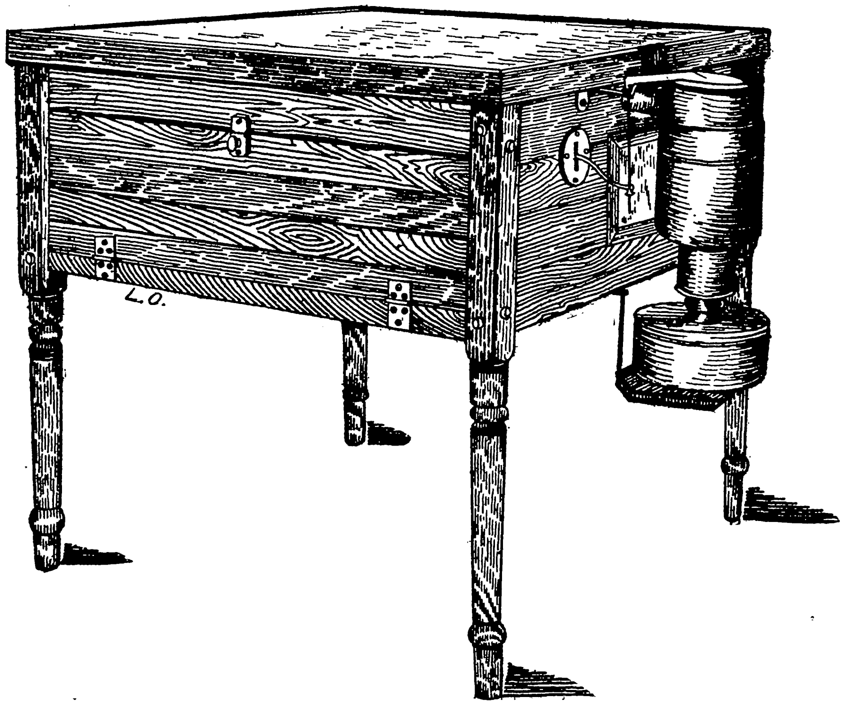


FIG. 41.—A first-class hatching machine.

roomy removable nursery tray below. All chips and shavings should be removed when the machine is inspected or before shipment. Makers of incubators must not lose sight of the fact that the construction of an incubator is a living problem. It has to do with the promotion of life and is not a mere matter of iron and wood. This business requires more skill and better workmanship than does the construction of thrashing machines and fanning mills. This machine operates upon living products and it must bring forth living creatures, else it is useless.

Purchasers should be cautioned against buying an incubator of large size for experimental or farm work. The so-called 100-egg size is large enough for the beginner. One tray and one egg chamber are enough.

HOW TO OPERATE AN INCUBATOR.

The agricultural papers and poultry journals are full of information upon the management of incubators, and many books have been published to furnish instruction upon this subject; but a great many farmers do not see these journals or the books. Once let it be known that the operation of an incubator is easy and simple, and once the almost superstitious dread that some people have of taking up something new is overcome, there will be little trouble in teaching the uses and management of the common hatching machine.

FIG. 42.—One of the best incubators.

At the outset the writer insists that the successful operation of an incubator depends upon accuracy and exactness. Not only should the work be done properly, but it must be done "on time." The woman who fills her lamps at a certain hour of the day, and the man who winds his watch or clock at the same hour every evening, need not fear the task of running an incubator. But unless one is willing to study, to read, and to practice, and is willing to attend to the few wants of his machine at the right time, making a specialty of promptness and punctuality, it will be unreasonable to look for chickens from the best incubator under his management.

The person who runs an incubator must be clean and careful; he must be at home with his machine at the same hour every morning

and the same hour every evening; he must learn the peculiarities of his incubator and carefully follow instructions. For such a person the operation of the ordinary hatching machine will be simple and easy enough. With each shipment the manufacturer sends out a book or card of directions. Read this carefully before attempting to set up the machine. Put the parts together in exact accordance with these directions. Count the parts and inspect them carefully; then put them together; see that the machine stands level; that the doors open and shut easily; that the regulator is in working order.

About this time comes the question, Where shall we set this machine? This matter of location is very important. It has much to do with success in hatching. First, it must have some permanency. It must be placed where it will not be disturbed, away from jars and vibrations, out of all drafts or where the breeze can not strike it and where the opening and closing of doors and windows will not affect it. The room occupied must be large enough and have a level floor. One needs room to work about an incubator. It should have a clear space around it, especially in front, and at the lamp end of the machine there should be plenty of room. The apartment should not be damp or dark. A clean, dry, light cellar is excellent for this purpose. Any dry, clean room will do, but, as before stated, drafts or currents of air over or around the machine are very detrimental. There should be no stove or other source of artificial heat in the room occupied by an incubator. The entire room should be clean and free from dust. Some of these items have been mentioned in the preceding lines, but their importance warrants a repetition here.

Common sense and circumstances will dictate the location of the machine, but the above suggestions will be found worth considering. One thing is certain, if the incubator is not afforded proper quarters it can hardly be expected to give good results. The room decided upon, the machine set up, its parts adjusted, and its level taken, it is now in order to clean, trim, and fill the lamp. The wick should be dry-trimmed with a pair of sharp shears before it is inserted in the burner. Then after being passed up and down the tube a few times it should be trimmed again and its corners slightly nicked or rounded. Now is the time to prove whether the burner is in perfect order and that the wick works freely and easily. The wick should now be moistened in kerosene and drawn back to its proper position for lighting. All dust and moisture should be wiped from the burner. Especially important is it that the start be made with a clean tube and sieve. The lamp should be filled within one-fourth of an inch of the top, and then after the burner is attached to the lamp the whole should be cleaned with a dry, clean cloth. The chimney also should be carefully cleaned with a

dry cloth. It should be free from dirt, dust, or grease. If the chimney is not kept perfectly clean the lamp will smoke, and a smoky lamp means a poor hatch. Dry cleaning cloths should be set apart for this purpose. All these details looked after, the lamp can be lighted and placed in position if the machine is a hot-air machine; but if it is a hot-water machine the lamp must not be lighted until the tank is filled with water in accordance with the instructions that accompany the machine. Study the structure of your lamp and exercise great care in putting it together as well as cleaning and filling it the first time. Familiarity gained and habits formed will be of value to the operator in the future management. Accuracy and thoroughness are important.

Use nothing but the best grade of oil. No incubator will do good work with poor kerosene. The best will cost less in the end. It will give more heat, less smoke, and make less dirt and less work. If oil is bought by the barrel do not accept it in an old barrel. It may be short in measure or it may contain water and rubbish in the bottom of the barrel.

With the incubator in its place, all parts adjusted, the tank, if any, filled with water, and the lamp lighted and wick turned up so as to give a clear, white flame—just high enough, but not too high—we are ready to balance the machine or to establish the ratio between the thermometer, the regulator, and the lamp.

The incubator should be run with the trays empty for at least twenty-four hours before the eggs are placed in the egg chamber. This gives it a chance to get well warmed throughout, and it also gives the operator time and practice in adjusting the regulator so that it will keep the egg chamber at the proper temperature. This temperature should be exactly 100° F. for several hours before the eggs are put into the egg chamber. All this time the lamp should be kept in order and made to burn with a clear, white flame, so that it does not smoke and so that it can be turned a little either up or down without smoking. This is essential. The blaze must be good from the start and the regulator balanced to a good flame, and this must be done before the eggs go into the egg chamber. It is easier and safer to experiment with the lamp and the regulator when the egg chamber is empty than when the machine is full of eggs. A few hours spent in adjustment will be time saved later on. Nearly every machine is accompanied by a card of directions for operating it, which should be studied and followed.

It is not the province of this article to explain the individual peculiarities of the regulators of different makes, but rather to show what results are to be sought. The damper over the top of the chimney should be kept free from the chimney, say about one-eighth of an inch

of space being left between or around the margin of the damper. If you are using a hot-water machine, allowance must be made accordingly and leakage looked for before setting the eggs. The general principle, so far as the regulator and the lamp are concerned, is the same in all machines. At the end of the experimental twenty-four hours, again fill the lamp and trim the wick, and with the machine running steadily at 100° F. the egg tray, loaded according to directions given below, can be placed in the egg chamber. The eggs should be clean and dry and should have been prepared and balanced, as suggested in the early part of this article. When filling the trays put in eggs enough to fill completely every space, with every egg lying upon its side. Do not stand the eggs upon end nor pile them one upon another. The filled tray being now placed in the egg chamber, close the door, being careful not to slam it and so disturb the regulator or the lamp. The machine can now be left by itself an hour. At

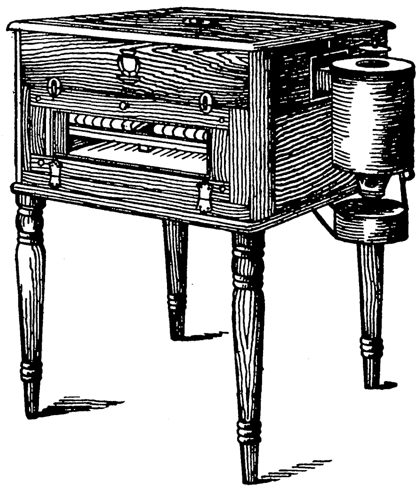


FIG. 43.—A well-made incubator.

the end of that time visit it, and if the thermometer still stands at 100° leave it again for another hour. At the third visit it may be necessary to turn the regulator thumbscrew, or the wick may need raising or lowering a little. It will be a matter of judgment at first whether you change the wick or the regulator. In most cases, if the blaze is about right, it is best to leave it so and to more completely balance the machine by a slight manipulation of the regulator, for if this is nicely done upon the start the temperature can be controlled during the entire period of incubation by slightly turning the wick. Note the repetition: Have your flame to suit you at the outset, leave it so, and adjust the regulator accordingly.

It takes twenty-four hours properly to test the lamp and adjust the regulator. During this time the eggs are gradually warming up, and the operator is supposed to be watching the machine and studying his instruction book. If a hot-water machine is used, some allowance must be made for the time occupied in warming the tank, unless it is filled with water already warmed. Let the operator bear in mind that each incubator has its own peculiarities and must be learned and managed accordingly. Another thing to note is that the manufacturer of an incubator is likely to understand its management and the operator is quite safe in following the printed directions for setting up and starting the machine; but, while the manufacturer understands the mechanical details of the construction and adjustment of his goods, his notions about the future management of his or any other machine may not be at all like, nor at all superior to, those of some other manufacturer. This is illustrated in natural incubation. One farmer sets all his hens in straw nests, another sets them all in chaff nests, another sets them all upon the ground and in earth nests, but the results are about the same. Methods may seem to differ and yet results may be very much alike.

The hatch can now be said to be begun. The incubator has been set up, adjusted, and tested under heat for twenty-four hours. It has been found capable of maintaining an even temperature, and the eggs are already warm in the egg chamber. The thermometer has been placed at a level with the top of an egg near the center of the tray. At first the work will require a few visits at intervals of not more than one hour apart, but after the third of these, if everything seems all right, the machine can be left alone for three or four hours, but the operator should be sure to visit it just before he retires for the night. On the morning of the second day the temperature should have risen to 102° F. It must not be forgotten that from now on the eggs will manifest a little heat of their own and this must be considered, as it will influence the action of the regulator. Or, in other words, if the egg is fertile the germ will begin to waken into life and possess and give off heat. This lessens the work of the lamp and should make the operator cautious in his manipulations of the regulator. The temperature from now on should be kept at 103° F. If the machine is balanced right, a very slight turn of the regulator button or of the wick elevator is all that will be required. The operator must not become overanxious now; he should resist all temptation to tamper unnecessarily. It is better to change the adjustment but a mere trifle and then wait a little to observe the result than to make great and abrupt changes. It is very easy to cook the eggs and quite as easy to chill them. All changes should be gradual, and the machine always be under the control of the operator. Once in good

working order, the less an incubator is disturbed the better. From now on it should be visited at regular intervals, three times a day—morning, noon, and night. At the same hour every morning the wick should be trimmed, the chimney cleaned, and the lamp refilled. The visit at noon is simply one of inspection and observation. At this visit the operator should look first at the thermometer and then at the lamp. If the temperature is right and the lamp is burning well, there is nothing more to do.

Returning to the work of the morning after, the lamp is cared for and started again, the operator should watch it carefully for a brief period. Then, if the thermometer shows the proper temperature, it is in order to turn the eggs. During turning the tray should be removed from the egg chamber and the door closed. Some of the details of turning have been given. The hand should be clean and the eggs gently rolled around. It should not require much time to turn the eggs, three or four minutes being sufficient. As a rule no other cooling is necessary, but this subject will be referred to later on. Many devices have been invented for turning the eggs, but the simple method of turning by hand is sufficient. Gently brush or roll them around or change them from one side of the tray to the other. The necessity for turning depends upon the fact that unless the egg is turned, its substance will gravitate, the egg will become too dry upon one side, and the chick will become attached to this dry side. Such an event will result in a dead or deformed chick. The whole process of turning is so simple that further explanation seems unnecessary. As to how frequently they should be turned, once a day is sufficient, though many practice turning twice a day. This turning should be continued from the third until the nineteenth day. After the usual signs of hatching can be heard the eggs must not be moved or disturbed. After the nineteenth day the rule "do not turn them," is imperative. The chick, ready to break its way out, has found its proper position, and to move the egg may so place the chick that it can not work to advantage or that it will drown or smother.

Cooling.—Many successful poultry men pay little attention to cooling the eggs further than to take plenty of time in turning. Much depends upon the machine, and more upon the condition of the atmosphere. If not exposed to draft or sunlight, the eggs can be left outside the machine for fifteen or twenty minutes and be none the worse for the exposure, but, as a rule, an exposure of five minutes is sufficient. That some cooling is necessary seems borne out in natural incubation by the practice of the hen, which leaves her nest from ten to sixty minutes every morning. Of course, the hen may do this for her own accommodation, but it seems to be part of the programme in natural hatching, and better results are obtained when

the eggs are cooled somewhat every day. This practice of cooling should be continued to the eighteenth day. Right here it may be well to advise the inexperienced operator to keep the egg chamber closed after the evening of the eighteenth day and until the close of the hatch.

Moisture.—This subject is one upon which opinions differ vastly. In the opinion of the writer much depends upon the incubator, its location, and the external atmosphere. All agree that a certain amount of moisture is needed. In natural incubation the hen leaves her nest early in the morning, while the dew is yet upon the grass, and if caught upon her return to the nest her feathers will be found to be wet. Yet some of the most successful hatches have been made by hens that were not allowed to leave the hatching pen. Hence the argument is not settled. But, from the fact that the early morning atmosphere is damp and the eggs are exposed to this moist atmosphere while the hen is off the nest, it is safe to infer that a limited amount of moisture is essential. If the incubator stands in a damp cellar, a very good hatch can be made without the introduction of any moisture into the egg chamber; while upon the other hand, if the machine is located in a dry room and the weather is dry, a poor hatch can be expected if no moisture is supplied. Many different methods of supplying moisture have been suggested, but most experienced operators incline to the simplest methods. A small sponge saturated with pure water can be placed in the egg chamber and allowed to remain there overnight, or a saucer containing a little water can be placed in the bottom of the egg chamber and left from time to time, or the hand of the operator can be dipped in warm water and brushed lightly over the eggs just before they are returned to the machine in the morning. The last seems to be a natural method and does not overcharge the egg chamber with wet air. Too much moisture will ruin the hatch, and it is better to err upon the side of too little than too much. A good rule is to note the barometer and in damp weather supply very little moisture. As to what is meant by much or little moisture, the writer thinks that a teaspoonful of water is plenty for 100 eggs in wet weather, while in dry weather an ounce is none too much, this being for a period of twenty-four hours. Or, again, if the machine stands in a cellar, a teaspoonful of water will last 100 eggs three days, while in a dry, well-ventilated room a tablespoonful of water every twenty-four hours will do no harm. The water supplied must be clean and pure and should be warm when it is introduced. Surely with these few hints the operator ought to be able to settle the moisture question for himself.

Testing.—The egg will show signs of hatching within thirty hours of its first exposure to heat. Along about the twenty-eighth hour a

point denoting the head and another denoting the heart will appear. About the forty-fifth hour the expert can detect a slight motion of the heart. In about seventy hours the membrane known as the allantois is visible. This envelope is the temporary breathing apparatus of the chick. On the fifth day the streaks denoting the limbs can be seen. On the sixth day the liver can be located, and a slight voluntary motion is observable. By the seventh day the lungs, stomach, and brain show development; the eyes can be found by the tenth day; and on the twelfth day feathers begin to form. The bill opens and shuts by the fifteenth day, and the cry of the chick is heard about the eighteenth day. Soon after, or early in the nineteenth day, the chick bursts the air cell at the end of the egg and begins to use its lungs in breathing. From this time it grows rapidly and soon becomes strong enough to break through the shell.

While the process of hatching is very interesting, the practical operator need not concern himself with minute details. The eggs should be tested at least three times during the period of incubation. First, as a matter of economy. Eggs not fertile will not spoil for a few days, and they will be as good for the table or feed after a few days in the incubator as after as many days in the nest. Again, eggs that are doubtful can be cooked for food for young chicks or cooped fowls. Another reason why nonfertile eggs should be discovered and removed is that they absorb some heat from the air of the egg chamber and generate none of their own. Again, if nonfertile eggs happen to be old when placed in the tray they are liable to decompose, and, by giving off poisonous gases, foul the air of the egg chamber and poison the chicks in the good eggs. However, it is not wise to disturb the eggs too frequently. Testing upon the seventh, the tenth, and the fourteenth days is quite sufficient. All nonfertile and all doubtful eggs should be removed from the machine as soon as their condition is detected.

The process of testing is simple enough after a little experience is acquired. It depends upon the appearance of the egg when it is held between the eye and a light. In order that the view may be most advantageous, it must be contrasted with a dark border. Many different egg testers have been devised, but they all depend upon the above principle. The simplest in construction is a plain tube about 1½ inches in diameter and made of tin, wood, or cardboard. The egg is placed snugly against the opening in this tube, and it is so held that the egg is between the tube and the light and the tube is between the egg and the eye. With the eye close to the uncovered end of the tube, a picture of the egg can be seen through the transparent shell. If the test is made in a dark room, a much better view can be obtained. A very fair test can be made in a dark room by holding the egg before

a small aperture in a window shade, provided the sun is shining against the window. In cloudy weather, when the sun can not be depended upon, some kind of an egg tester is required. All manufacturers furnish some kind of egg tester with every machine sent out, and the most of them work upon the same principle and are operated in the same way. Evening is the best time for making the test. Have ready a low table and an empty tray, also a basin or a basket. The operator can work best if seated at the table with the lamp in front of him; upon his left is the tray of eggs to be tested, with the empty tray and basin upon his right. Every detail should be arranged before the eggs are removed from the egg chamber, as a prolonged exposure is to be avoided. One by one the eggs are taken from the tray, tested as above suggested, the appearance observed, and the egg, if fertile, placed in the empty tray, or, if infertile, placed in the basket. As soon as all are tested the tray containing the fertile eggs is replaced in the incubator, the door of which is then closed and the machine left as before. Experience soon teaches one the appearance of the nonfertile and the spoiled egg, as contrasted with that of the fertile egg which has already begun to hatch. The fertile, or hatching, egg will show a spiderlike formation, a center with long crooked threads, or rays, leading outward, and this formation will float as the egg is turned, seeming to have an inherent power of motion. Such eggs are good and the germ is alive and hatching. But if this formation is a black stationary spot and the red lines come together in a circle, the egg is one that has been fertile, but the germ of which is now dead. Such an egg should be removed from the tray at once. The egg that remains clear except for a small dark cloud is infertile and may possibly be used in cooking. In case an egg is doubtful it can be marked and returned to the tray and left there a few days to be tested again. All eggs that cool too quickly should be marked for special examination, and remember that the egg that does not contain life will be cooler than the live egg. Cracked eggs can be saved by the use of court plaster, but unless it be from a rare or valuable fowl the attempt to hatch a broken egg will hardly be worth the trouble. At the second testing, about the tenth day, the eggs that are hatching well will be nearly half darkened, while the others will look more or less as they did in the first test. On the seventeenth day the chick will be seen to fill all the egg but the air space, unless it has died in the shell since the previous testing. The final testing should be carefully made and with the shortest possible exposure.

The air cell.—Books upon incubation devote much space to this subject. The writer thinks it cuts but little figure in the work of the operator. If the air cell is too large the egg is too dry, while if not

large enough the egg is too moist, and the moisture supply can be governed accordingly. Experience will teach the operator much more about the air space than will written pages, and until he is experienced he need not attach very great importance to it unless it be unusually large or small. By the end of the sixteenth day this occupies about one-fifth of the space in the egg, and the chick ought to occupy the remainder of this space. The air cell gradually increases until the eighteenth day. Upon the eighteenth day, or the nineteenth day at most, the eggs are turned and cooled for the last time. After this do not disturb the eggs. If necessary, partly close the ventilator slide. Leave the door closed. Of course, the thermometer must be watched and the lamp filled and trimmed more carefully than ever. Do not be alarmed if the thermometer shows a temperature of 104° at this time. No harm will be done if the eggs are kept at that temperature a few hours.

The operator is again cautioned to let the eggs alone during the last two days of incubation. If the door must be opened to rearrange the thermometer or to supply moisture, it should be for a brief period only, and great care should be exercised not to jar nor change the positions of the eggs. But the lamp should be kept in good order and the regulator and thermometer watched closely. Some of this has been stated before, but it will bear repeating, for many a good hatching prospect has been blighted by overanxiety or curiosity.

At the end of the twenty-first day open the door and pull the tray partly forward. Then remove the shells and, if any chick is found with the shell dried upon it or in any way attached to it, carefully liberate the chick and place it in the nursery below. Then carefully close the door and let the machine alone for another six hours unless the eggs are all hatched sooner.

The eggs about all hatched, now is the time to clean and set up the brooder, which should be heated a few hours before the chicks are removed from the nursery. After the hatch is completed and the chicks are removed from the nursery, the machine should be taken apart, carefully cleaned, and set right for future use. The brooder should be started at about 98° F. and gradually lowered at the rate of 1° a week, according to the weather and the experience and judgment of the poultry man.

The chicks should not be fed until they are thoroughly dried and have been out of the incubator at least twenty-four hours. The first feed should be fine sharp grit or sand, upon which is sprinkled a very little hard-boiled egg chopped fine. After this they should be fed every three hours a little broken grain or, better yet, some of the excellent prepared dry chick foods upon the market. Clean, fresh water should be supplied from the start. Wet, sloppy food should

be avoided. If none of the manufactured chick foods are at hand, a substitute can be made by cracking a mixture of wheat, corn, and egg shells. Any good poultry journal will give valuable hints upon the subject of raising chickens in brooders.

SUMMARY.

Study your incubator.

Acquaint yourself with all its parts.

Read the manufacturer's directions for setting it up.

Set it up carefully and according to instructions.

Never try to run an incubator in a drafty place, nor near a stove, nor where the sun shines upon it.

Set fertile eggs only. Waste no effort upon those that are doubtful.

Learn how to trim and clean a lamp.

Keep the lamps full and the wick and tube clean.

Avoid smoke.

See that the eggs are clean and dry before setting them.

Balance all eggs, large end up, a few hours before placing them in the tray.

Do not overfill the tray.

Turn every egg the third day.

Cool the eggs every morning.

Be sure your hands are clean when handling eggs.

Test all eggs by the seventh day.

Test again by the eleventh day.

Test again by the fifteenth day.

If the air space is too large, supply moisture; if too small, put a saucer of dry lime in the room and run without moisture a day or two.

Do not expect to learn all about the air cell the first hatch. You will learn that later.

Do not disturb the eggs after the evening of the eighteenth day.

Have a regular hour for incubator work.

Do not tinker too much with the regulator.

Get the adjustment right and keep it so.

Heat your machine and make your adjustment before placing the eggs in the egg chamber.

GENERAL REMARKS.

The average farmer, his wife, his son, or his daughter, should not expect to learn all about the management of an incubator from the perusal of written pages. Experience comes from the work itself. This work is easy, interesting, and fascinating. It occupies the mind and leads to investigation. More than that, it leads to success and profit. But great results can not be expected in the beginning. The poultry

business is a trade and must be learned. Many a person is idle to-day and looking for some sphere of usefulness who could learn how to operate an incubator to both mental and financial advantage. But the work, slight as it is, must be done properly and at the right time. The poultry business is honorable and profitable, but it requires study and experience. We serve a long and faithful apprenticeship to learn other more laborious and less remunerative trades, when the same amount of application would in less time make us experts with an incubator and give us a trade in a line not affected by strikes or lockouts, or liable to be overcrowded.

THE POULTRY INDUSTRY OF PETALUMA, CAL.

By P. H. Lawler,
Petaluma, Cal.

THE INDUSTRY THROUGHOUT THE STATE.

There are no records which show the beginning of the poultry industry of California. Certainly poultry were here as early as 1850, when immigrants brought them "across the plains" from "the States" for foundation stock upon the new farms to be opened or in the mining districts. Gold mining absorbed the attention of all men in those days, and the preservation of the chicken industry devolved therefore upon the women and children. It was many years later before a gold mine was discovered in the chicken industry.

It must not be understood that all parts of the State are equally well adapted for poultry raising. The raising of chickens, for instance, is not generally a paying business except upon a strip 40 miles wide along the Pacific. Turkeys, however, thrive in all parts of the State, and the counties of Mendocino, Colusa, Glenn, Tehama, and Lake are regarded as the turkey center. In these counties it is not unusual for one to see flocks of turkeys ranging in number from 2,000 to 5,000. Grain is produced in this section in large quantity and feed is consequently comparatively cheap. The turkeys of Mendocino and Lake counties have a reputation for their excellent table qualities, and thousands of them are annually marketed in all sections of the State. The high, dry ranges in the foothills afford excellent runs for turkeys. Geese and ducks are found in every part of the State.

PETALUMA A POULTRY CENTER.

The year 1889 found many people engaged exclusively in the poultry business in Sonoma County, especially in the neighborhood of the town of Petaluma. This town, which has a population of about 5,000, is 36 miles in a northerly direction from San Francisco, on an arm of San Pablo Bay. The surrounding cities, including San Francisco, have a combined population of 600,000, and all these draw

largely upon the Petaluma district for eggs and poultry. The soil, except east of the town, is of a sandy loam, in some places containing clay and gravel. East of the town the soil is adobe, and on this the chickens do not thrive well. Shade and good water are everywhere abundant. From May to October there is no rain; a few frosts occur in December and January; there is never snow and ice. In the wet season the temperature is usually from 60° to 65° F.; occasionally it drops in winter to 35° to 40° F. In the summer the temperature usually is about 70°, but some times, for a few days only in a season, it reaches 95° F. The annual rainfall is about 30 inches.

A few years ago the land about Petaluma was in stock and dairy farms, but all this is now devoted also to poultry. About nine-tenths of the people who are living near the town are engaged in raising poultry. In the town itself there may be found a few hens in every back yard. In the suburbs there are on acre lots from 600 to 1,000 fowls. Farther out, a mile or two from the town, the tracts contain from 3 to 10 acres; 4 or 5 miles out the farms are from 10 to 100 acres in extent; and at a distance of 10 to 15 miles there are poultry farms of 500 to 600 acres. There is a small valley about 3 miles from the city where there are 40,000 laying hens on a single square mile, not to mention the hundreds of thousands of chicks that are hatched there every year.

In this connection it is interesting to note that in the immediate vicinity of Petaluma there are 1,000,000 laying hens. If it were possible to add to this the number of males employed and the number of chickens sold annually an idea would be had of the very great number in that locality.

It will be very natural for readers of this article to desire to know what the income is from a given number of hens. Of course, egg and poultry production is like any other business in that the one who knows his work best and attends to it most assiduously is the one who succeeds in marked degree. As an example of what may be done in one year with 500 hens, the following tabular statement is given. The prices are such as have obtained in this locality:

3,723 dozen eggs, at 31½ cents	$1,170.75
145 broilers, at 42½ cents	61.62
200 pullets, at 50 cents	100.00
Total	1,332.37
Cost of feed	400.00
Profit	932.37

It should be stated, however, that the poultry raisers of Petaluma expect an average annual income of $1 per hen only.

SHIPMENTS OF POULTRY AND EGGS.

In 1889, when the poultry business of Petaluma first came into prominence, one of the leading expressmen says he was doing well when he handled 50 cases (a case equals 36 dozens) of eggs per day. At the present time he handles from 200 to 300 cases a day. Other expressmen give similar experiences.

Fowls are shipped alive in coops of wooden frames having wire rods or heavy hexagonal-mesh wire netting. Eggs are shipped in an especially heavy case holding 36 dozens.

The following statement of the sales of eggs and poultry at Petaluma is from the daily records kept by the Petaluma Poultry Journal of that place:

Shipments of poultry and eggs for the year 1903.

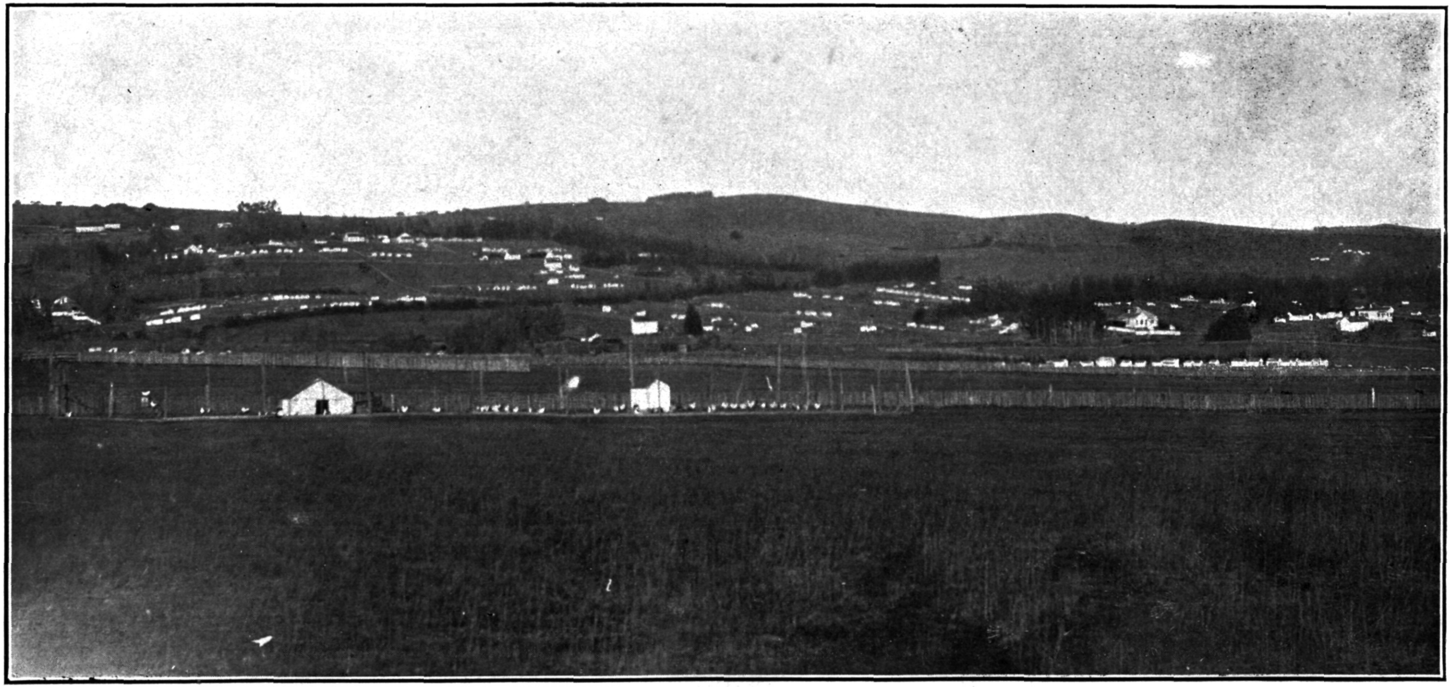
Month.	Eggs.	Poultry.	Month.	Eggs.	Poultry.
	Dozens.	*Dozens.*		*Dozens.*	*Dozens.*
January	96,485	1,301	August	197,635	3,582
February	258,164	1,698	September	195,954	3,959
March	562,258	1,479	October	127,254	2,486
April	558,048	2,362	November	95,966	2,615
May	448,782	1,780	December	135,039	1,875
June	447,996	5,006	Total	3,406,335	31,545
July	242,754	3,392			

These products are all marketed in San Francisco—some to go into the mining districts, but much the greater part goes to fill Government orders and for shipment on steamers for Alaska, Hawaii, and the Philippines.

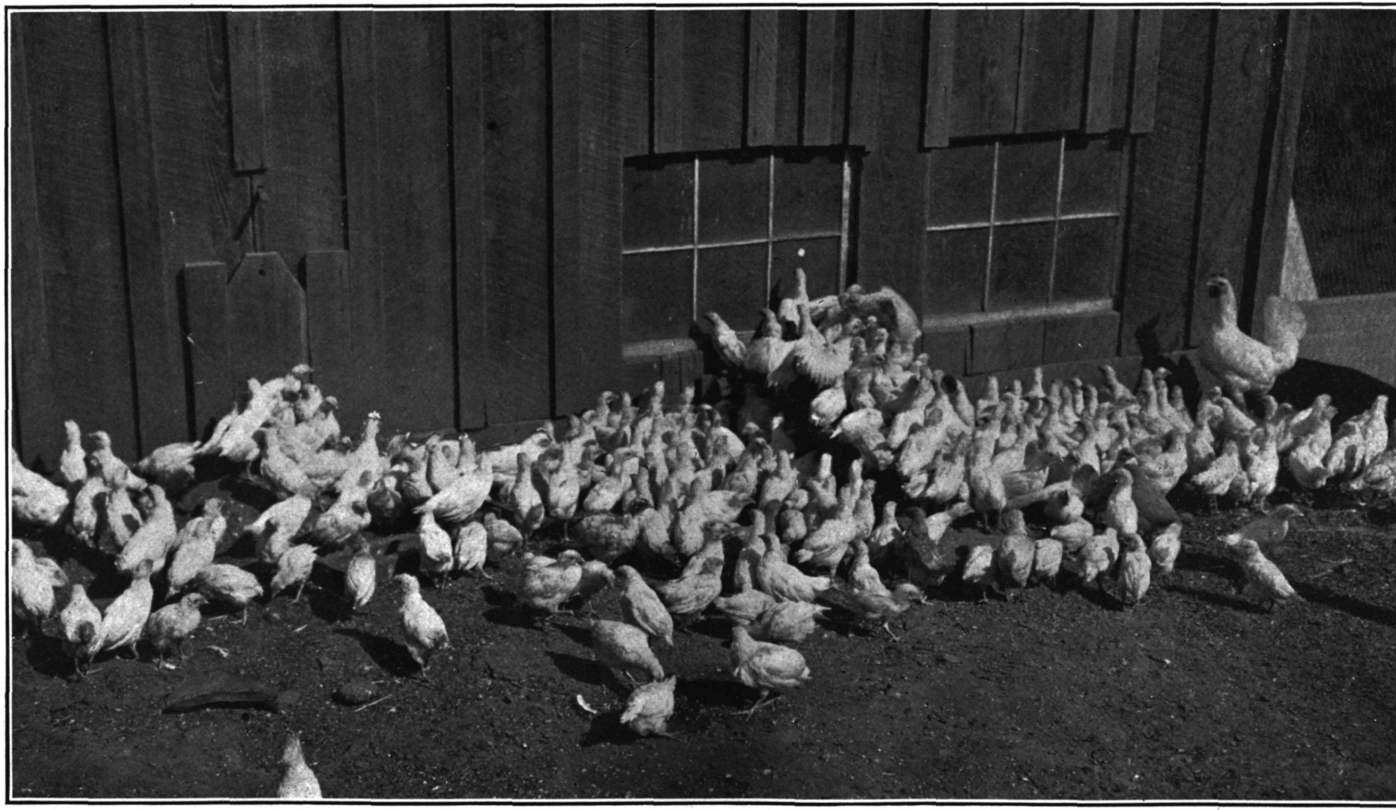
In Petaluma there are twelve firms dealing exclusively in poultry and eggs, as well as branches of two large commission houses of San Francisco. These houses pay out about $3,000 a day for poultry and eggs.

Incidentally let it be stated that San Francisco receives poultry products, in addition to those from Petaluma and other parts of the State, to the value of $1,500,000 annually. These products are called " eastern " as distinguished from " coast." The eastern eggs received in 1903 amounted to 824,648 dozens. In 1904 they increased to 1,109,160 dozens.

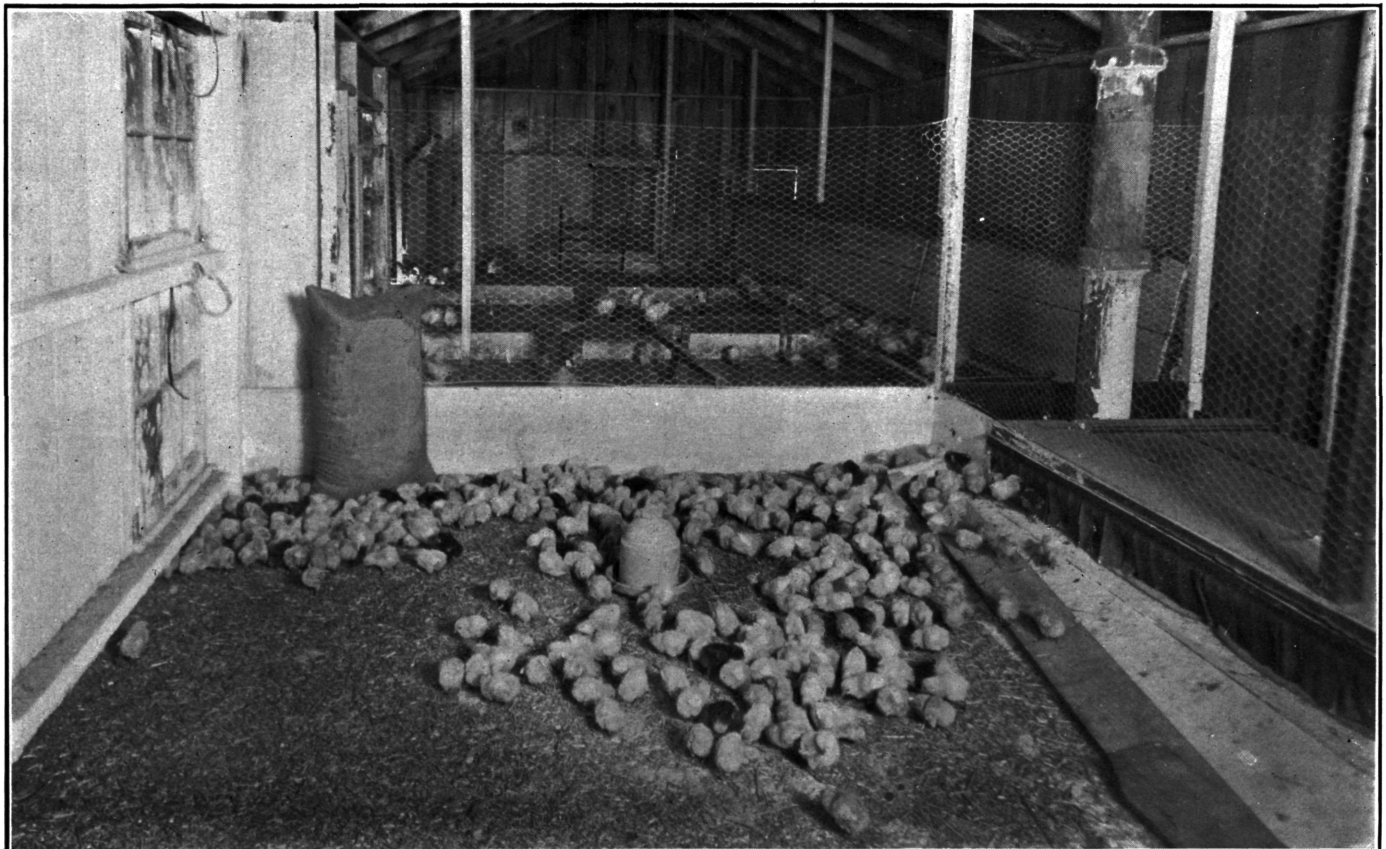
The following table shows the average prices of eggs in the San Francisco market for the years of 1903 and 1904 and the amount of coast eggs received for the same years.



Forty Thousand Chickens on One Square Mile of Territory.



Interior View of Brooder House.



WHITE LEGHORN CHICKS.

Average prices and quantity of eggs received in San Francisco, 1903 and 1904.[a]

Week ended—	Prices of eggs per dozen.		Receipts of coast eggs.	
	1903.	1904.	1903.	1904.
	Cents.	*Cents.*	*Cases.*	*Cases.*
January 7	30	35	3,170	3,681
January 14	30½	31	3,618	5,161
January 21	30½	27	3,674	5,847
January 28	31½	25	3,880	5,592
February 4	34½	26	5,702	6,049
February 11	35½	26½	5,532	6,807
February 18	34	25¼	6,153	6,709
February 25	33½	24½	7,320	6,508
March 3	29	20½	9,511	8,883
March 10	26	17	9,148	8,791
March 17	25	17	10,029	8,914
March 24	25½	20	10,180	9,691
March 31	25	21	11,908	9,834
April 7	24	19½	11,974	9,375
April 14	22	19	11,132	9,508
April 21	21	19	10,540	8,538
April 28	21	19½	11,667	10,026
May 5	21	21½	11,577	9,633
May 12	21½	21½	11,175	9,088
May 19	24	19½	11,445	9,261
May 26	23½	19	10,586	9,603
June 2	23	19	8,057	9,251
June 9	24	21½	8,422	8,722
June 16	25	23	8,146	8,533
June 23	25	23	7,128	7,465
June 30	24½	22½	8,369	7,962
July 7	24½	23	6,480	6,912
July 14	25½	26	6,190	8,473
July 21	26½	28	6,221	8,110
July 28	25½	25½	5,080	8,388
August 4	24½	26	5,241	8,034
August 11	25	26	4,796	5,363
August 18	27	29	4,347	4,680
August 25	28	30½	3,727	4,417
September 1	29	33	4,561	4,011
September 8	29	35	2,388	3,533
September 15	30	35	4,015	4,337
September 22	31	37	3,488	3,549
September 29	30	40	3,445	3,732
October 6	28½	39	3,334	3,507
October 13	27½	39½	3,598	3,235
October 20	28¼	40	3,439	3,373
October 27	29	41½	3,886	3,193
November 3	30	43¼	3,977	3,231
November 10	31½	48	3,685	3,005
November 17	32½	48½	3,609	3,398
November 24	32	43½	3,635	3,075
December 1	30	39	3,671	3,518
December 8	28¾	38	3,701	2,802
December 15	27¾	39½	3,827	2,781
December 22	26	40	3,920	2,816
December 29	26	40	4,141	3,028
Total			328,445	323,933

[a] These statistics are from Dairy Produce and Review.

Thus we see that the coast eggs received on the San Francisco market in 1904 amounted to 11,661,588 dozens. The importance of Petaluma as an egg-producing center is strikingly apparent when we subtract her output of 3,406,335 dozens in 1904 from the above, leaving a balance of 8,255,253 dozens for all the rest of the State.

BREEDS OF CHICKENS IN USE.

The breeds of chickens that form the basis of this large industry in the vicinity of Petaluma are as follows: Barred Plymouth Rocks, Brown Leghorns, White Leghorns, and a few other varieties in small numbers. However, the White Leghorns soon demonstrated their special adaptability for the conditions obtaining in this locality, and they now predominate in an overwhelming degree; in fact, it is said that the vicinity of this town is called one vast White Leghorn farm.

METHOD OF HATCHING AND RAISING.

The hatching and raising of the chickens is practically all done by artificial methods. Not one one-hundredth of 1 per cent is now hatched by the hen. Artificial incubation is so important that a large incubator plant is located at Petaluma. In order to demonstrate the fitness of the hatching machine, this factory conducts a hatchery in which 2,500 eggs are always in course of incubation. On December 16, 1904, 9,000 chicks were hatched in one incubator establishment in Petaluma.

There is here a chicken hatchery which is believed to be the largest in the world. It consists of an incubator house in which 30,000 eggs are in all stages of incubation; two houses, each 300 feet in length, and each having a capacity of 2,500 laying hens; and two brooder houses, each 160 feet in length, and having a combined capacity of 100,000 broilers a year. In this plant a ton of feed is used at each feeding time. Electric cars are used in the buildings for carrying feed and wash water and for collecting the eggs and the offal. The daily gathering of eggs is about 3,600.

The feed is all stored in the upper floor and is delivered into the feed troughs by means of chutes. Water is furnished by a system of pipes to each pan. The floors are all of concrete, and the whole institution may be whitewashed in three hours by the use of machinery.

When the chickens are ready to be removed from the incubator they are transferred to brooding houses, where they are placed in small individual hot-air brooders having a capacity equal to 1,000 chicks. When the chicks graduate from the brooders they are placed in small houses and taught to use the perch. Here they

remain until the sexes are separated and the cockerels are marketed. There are no yards in connection with some brooding houses, while there are extensive ones in connection with others.

A large quantity of the feed is of mixed grains ground and sold as a balanced ration, wheat being the standard feed. Whole corn is used in the winter months, but none in the summer. The ground product is given to the chicks. The corn used comes in carload lots from eastern States.

COLD STORAGE FOR EGGS.

There is located at Petaluma a cold-storage plant with a capacity for 10,000 cases (360,000 dozens) of eggs. In one day in 1903 this plant paid out $3,529 for 16,927 dozens of eggs. It has been ascertained here that the average loss of eggs placed in cold storage amounts to the very small number of 2 for each case of 36 dozens.

THE TURKEY INDUSTRY OF CALIFORNIA.

The following information about the turkey industry in California is furnished by Mr. Ed. Hart, of Clements, Cal.:

The turkey industry of this State is becoming a very important one. During the last two years the demand has exceeded the supply. Turkeys have been grown here for over thirty years, but the demand has never before been so steady and the prices so remunerative as at present. The demand is especially large at Thanksgiving and Christmas times. During these holiday seasons the San Francisco receipts are from 250 to 300 tons. Besides, Oregon sends from 20 to 40 tons more, and from 50 to 70 tons come from the East. The largest receipts of California turkeys were formerly from the southern part of the State, but now they are from the northern part, the largest producing counties being Colusa, Glenn, Tehama, Mendocino, and Lake.

The prices that have been paid for turkeys in the San Francisco market during each week of 1903 and 1904 are shown in the following table, which has been compiled for use here by J. Zentner & Co., of San Francisco:

Prices of turkeys in 1903 and 1904.

Date.	Live.		Dressed.	Date.	Live.		Dressed.
	Grown.	Young.			Grown.	Young.	
1903.	*Cents.*	*Cents.*	*Cents.*	1903.	*Cents.*	*Cents.*	*Cents.*
January 3	17–18		20–22	March 14	15–17		18–20
January 10	17–18		21–23	March 21	15–17		18–20
January 17	17–18		21–23	March 28	15–17		18–20
January 24	17–18		19–21	April 4	15–17		
January 31	17–18		20–22	November 7			20–23
February 7	17–18		20–22	November 14			20–24
February 14	17–18		20–22	November 21			21–24
February 21	16–18		18–20	November 28	20–22		22–25
February 28	15–17		18–20	December 5	21–23		25–28
March 7	15–21		18–20	December 12	19–22		20–23

Prices of turkeys in 1903 and 1904—Continued.

Date.	Live.		Dressed.
	Grown.	Young.	
1903.	*Cents.*	*Cents.*	*Cents.*
December 19	19–21		20–22
December 25	18–20		20–23
1904.			
January 1	16–18		18–22
January 9	18–20		22–25
January 23	14–16		17–20
January 30	15–17		18–20
February 6	15–17		18–20
February 13	15–17		18–21
February 20	15–17		18–21
February 27	15–17		18–21
March 5	16–17		16–21
March 12	16–18		18–22
March 19	16–18		18–22
March 26	16–18		18–22
April 2	18–18		18–22
April 9	16–18		18–22
April 16	16–18		18–22
April 23	15–17		16–18
April 30	15–17		18–20
May 7	14–15		18–20
May 14	14–15		18–20
May 21	14–15		18–20
May 28	14–15		18–20
June 4	15–16		
June 11	14–15		
June 18	14–15		
July 2	14–15		
July 9	14–15		
July 16	14–15		
July 23	14–15		
July 30	15–17		
August 6	15–17	24–25	
August 13	15–17	24–25	
August 20	15–17	24–25	
August 27	15–17	20–25	
September 3	14–15	20–22	
September 9	14–15	20–22	
September 17	14–15	20–22	
September 24	14–15	20–22	
October 15	14–15	18–22	
October 22	14–16	20–22	
October 29	14–15	20–22	
November 5	15–18	21–23	
November 12	17–20	20–22	23 –25
November 19	17–20	20–22	20 –26
November 26	14–15		12½–18
December 3	15–17		18 –23
December 10	16–18		22 –25
December 17	18–20		20 –22
December 24	20–22		24 –27
December 31	21–23		24 –27

In this State the farmer who a few years ago regarded turkeys as a nuisance which could not be tolerated has arrived at the conclusion that turkey raising is a source of great profit. The wives and children of farmers have taken up this industry vigorously. There is no live stock on the farm that is raised with less trouble and expense than turkeys. The most trouble encountered is during the first six weeks, after which they will hunt their own food. One hundred young turkeys can be maintained the first six weeks on $1 worth of feed. Then add to this about $25 worth of feed at fattening time and we have about all of the cash outlay. The income from the lot should be from $200 to $250.

INFORMATION CONCERNING THE MILCH GOATS.[a]

By George Fayette Thompson, M. S.,
Editor of the Bureau of Animal Industry.

SOME PRELIMINARY REMARKS.

In these days the American people are not only willing but anxious apparently to take up the work of any line of inquiry or experimentation that will add in any particular to the wealth or happiness of mankind. Mere sentiment exerts but little influence in such matters. "Will it pay?" is the chief question concerning any new proposition, whether it be the establishment of an animal industry, a factory, or a college, and the permanency of the thing proposed depends upon an affirmative answer to this question. So it is that such specialties as the raising of chickens, ducks, geese, ostriches, frogs, etc., on a large scale have been established.

Notwithstanding the above facts, all special industries like those named are beset with ridicule to some extent and are thus oftentimes unmistakably hindered in their progress. Those who have become interested in goats have expected more of such ridicule than they have actually received, and it can now be said that everybody is the friend of the Angora. Probably the highest compliment that was paid to the author's bulletin on the Angora goat was by one of the celebrated papers devoted to humor, in these words: "The only funny thing about the book is that the author treats the subject seriously." The author could wish for no higher compliment for this work on milch goats. The goat has been the friend of man from the beginning and it can not be spared now without creating a deficiency in the sum of human comfort and happiness.

Since it has become evident that the Angora goat industry is quite securely established throughout the country generally, many people have very naturally begun to consider the possibilities of another industry, which in some respects is closely allied to it, namely, the milch goat industry; and the Bureau of Animal Industry has found it necessary to gather a large amount of data in order to answer the numerous questions that it has received concerning every phase of milch goat management. These requests have come mainly from two

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classes of our citizens—those who were reared in foreign countries where goat's milk was very largely or solely used and those who have read of the economy of goat keeping and the reported value of the milk for children and sick people. The second class includes many physicians who, believing in the hygienic virtues of goat's milk, would like to see goat dairies established in the neighborhood of all large cities, so that a constant supply of the milk might be available at all times.

Milch goats are a prominent feature of the live stock industry of Europe, especially in Switzerland, Italy, Germany, Austria, France, Norway, and Spain. They are peculiarly adapted to the needs of the poorer classes of those countries, and, to a large extent, it is this adaptability that recommends them for many localities in the United States. This is so because milk, which is food and drink to all mankind, is furnished by the goat in cheap form, because for most purposes its quality is superior to cow's milk, and also because the yield of milk, when size of animal and amount of feed are concerned, is much greater than that of a cow.

The number of goats in the world could be only roughly estimated, and to say how many milch goats there are among them would be but a guess. German writers on milch goats have estimated that there were about 3,000,000 goats in the German Empire in 1892. As there was an increase shown for every decade from 1873, it is probable that the number is considerably augmented at the present time.

Dettweiler (1892) gives some statistics regarding the milch goat industry of Germany which are interesting. His estimate of the annual value of the goat business is as follows:

Goats and goat products in Germany, 1892.

Value of goats	50, 000, 000 marks	($11, 900, 000)
Value of milk produced	150, 000, 000 marks	(35, 700, 000)
Value of kids slaughtered	7, 500, 000 marks	(1, 785, 000)
Value of goats slaughtered	6, 500, 000 marks	(1, 547, 000)
Total	214, 000, 000 marks	(50, 932, 000)

It therefore appears that the milch goat industry of Germany is worth annually about $39,000,000, after the value of foundation flocks is deducted. It is indeed a business of no small importance, and for the whole of Europe the total value must certainly reach enormous proportions.

It is officially stated that the production of goat's milk in Switzerland in 1901 was 19,875,000 gallons. At an estimated value of 10 cents per quart, this equals nearly $8,000,000. The number of goats there of both sexes and of all ages for that year was 354,534, which was 135,000 more than the number of sheep. Although Switzerland

is peculiarly adapted to goat raising, we should remember in making comparisons and estimates that her total area is about 16,000 square miles only, and that much of it is in mountain tops entirely unavailable for any use. Indiana is more than twice as large as Switzerland, and Texas has an area more than sixteen times as great. All this shows that the goat business of that little Republic is of considerable importance, yet most cyclopedias and gazetteers mention it in a word only or not at all.

PRESENT SITUATION.

The present situation regarding a milch goat industry in the United States is confined largely to an awakening interest, although there are now some communities of foreigners where a considerable number of goats are kept for milk, the kids being fitted for slaughter. This is specially true of Italian colonies. Besides, correspondence of this Bureau has brought to light the fact that occasionally in isolated places the common American goat has for some time been kept in very small numbers for milk production. The matter has been given no publicity, yet the goats have apparently fulfilled all expectations. For instance, A. M. Evans, Lonaconing, Md., mentions a few goats in his possession which, when first in milk, yield 2 quarts each per day. The foundation of his flock was gathered together in Allegany County several years ago by a gentleman upon the advice of a physician who recommended the use of goat's milk for an invalid in the family. The goats increased in number and became quite well known in that county, but they were attacked by ridicule, which proved almost fatal to the enterprise, and very few animals remain at this time. In another recent letter of inquiry about sheep in New Jersey, the facts came to light that there are about 500 goats kept by the Italian colony at Palisades Park, N. J., and that a good revenue is derived from the milk, butter, and kids. In all probability we shall hear of several other such instances, especially in the Southern States, where there may be a few goats only in a place.

In discussing the situation as it is at this time, it seems proper to mention here the efforts made by Mrs. Edward Roby, of Chicago, to bring together as many as possible of the best American milkers and to establish a flock that shall transmit the milk characteristics to their progeny; in short, she is seeking to develop an American milch goat. Her purpose is philanthropic, and is carried out by furnishing these goats at low rates and on easy terms, if necessary, to the heads of such households as are most in need of them, in order that the children may be better nourished and be relieved largely from the danger of disease that lurks in much of the cow's milk that finds its way to such households. Persons living in the suburbs who obtain one or two of these goats usually have a lot large enough for the animals and can

provide feed for them. This should insure more and better milk than that from cows which they have been in the habit of using, and they are at the same time enabled to save a considerable sum on the grocery bill.

Mention will be made elsewhere of the purebred milch goats that have been imported into the United States. These purebred animals are all from Switzerland and, with one exception, were imported in April, 1904. They are located in Ohio, Maryland, New Jersey, New York, and Massachusetts, but it will be several years before their influence is widely felt.

ECONOMY OF GOAT KEEPING.

So far as we can apply the leading features of the milch goat industry of Europe to the conditions prevailing in the United States, it can be said that the goat is needed by the poor man who can not afford to keep a cow, and by those people especially who live in the suburbs of the large cities and those who work in the mining districts. Dairies should also be conducted according to approved modern methods, so that a constant supply of milk may be had for sick people and for children whose mothers do not properly nourish them. These are matters of such importance that German writers, referring to the industry in their own country, say that the milch goat in its later development has done great service to the state, in that it supplies a want which before caused great unrest among the peasantry.

In Germany the goat plays the part in the households of poorer people, especially of the day laborers, that the cow does in the households of the well-to-do classes. Hoffmann says that the proportion of households in Germany that keep goats is 75 per cent, and that the keeping is not confined to the poorer people, but that the prosperous middle classes consider the goat of advantage to them also.

> It furnishes to its owner, without doubt, the best milk for nourishing infants, for the household, for the cooking of food, and for coffee, besides butter and cheese. When one considers that it very often depends solely on the milk production of the goat whether the nutrition of the child and the whole family is bad or good, and the nutrition from infancy on has a bearing on the ability to perform a greater or a comparatively small amount of work in later life, then one will believe me when I say that the goat is in a position to wield a great influence in sustaining life.—*Dettweiler.*

Petersen, with the peasantry of Germany in mind, sums up the worth of the goat in this manner:

> (1) The possibility of procuring a goat is generally within the reach of the poorest families; (2) the risk and the insurance premium are disproportionately much less in the case of the goat; (3) the goat utilizes its food better than the cow, and gives considerably more milk in proportion to its body weight; (4) the goat is satisfied with little feed, and with feed of any sort, which is to be had at much less cost; (5) by keeping two goats instead of a cow, the family of the workingman may be provided

during the entire year with milk by the proper regulation of the time of the birth of the kid; (6) the goat gives a more wholesome milk than the cow and the milk is richer in fats.

As to the question of human nourishment, the goat occupies an important position. It yields a wholesome nourishment for the family, serves as a useful and agreeable occupation for wife and children, and awakens in its owner a desire for industry and a spirit of frugality. So long as the workingman is happy in the possession of a business, has a small bit of ground to call his own, and has a profitable domestic animal, just so long will he be an opponent of social strife; a careful provider for his family, and an adherent of some recognized creed.—*Hilpert.*

In Saxony the goat plays an important rôle as the source of the milk of the household; likewise that the homes that are here under consideration belong to that class of people who are without much means. Especially in the industrial districts of the mountains, with a preponderance of the smaller manufactories, the goat is the supporter of the family—in a broad sense, of the people among which it finds its manifold uses. In this way it comes about that goat's milk is such a universally established food material, and one of which the people have become so fond, that they will pay the same price (or in many places even a pfennig higher price) for it than for cow's milk, which latter serves to help out when there is a scarcity of goat's milk. The reason for this may be found in the higher nutritive value of goat's milk, and the assertion is often made here that anyone who has become accustomed to the use of goat's milk for coffee feels it a degradation if he is compelled to be content with cow's milk in its stead, which is not so pleasant to the taste and is poorer in fat than goat's milk. But the goat is beginning to rise in prominence and gain in numbers in highly developed thickly settled districts where the people are more prosperous.—*Dettweiler.*

We had a terrible season last year and most of us lost heavily in sheep, but the goats kept us going on their milk all the time; and it was in that dry time that I overcame my prejudice and ate and relished goat meat, or, as you would call it, venison. The goats served us well until the rains came. I have just asked my girls about the flock, and they tell me they milk eighteen nannies and make from 4 to 5 pounds of butter weekly from them and have, besides, an abundance of milk for our household of seven and a hired man.—*J. R. Chisholm, Queensland, Australia.*

Such remarks as the above might be copied by the score from foreign books and journals, but those given are sufficient to show the conditions under which the goats are kept and that some of those conditions obtain in the United States and are responsible for the growing interest in milch goats. It will no doubt occur with this new industry, as it has occurred with others at the beginning, that many will enter it who will become overenthusiastic from a little success, while others, expecting much, will condemn all because of a little success only. Neither of these classes will be helpful to the industry. If a milch goat industry is to succeed in this country, it must be upon rational lines.

CLIMATE AND SOIL.

The climate suitable for milch goats is as varied as the breeds of the animals themselves. It would not be safe, in the absence of actual experience, to say that the long-haired goats are best suited to the colder climates and the short-haired ones suitable for the warmer climates only; for in Switzerland, Germany, France, Italy, Spain, and

Malta there are found both kinds, while in Syria, where there are extremes of temperature (from almost perpetual snow on Mount Hermon to tropical heat at Joppa and the Dead Sea), the goats are of the long-haired variety. The goats of Egypt, too, are long haired.

However, notwithstanding the above facts, experience with goats in the United States shows that the short-haired variety will suffer with cold if no protection is provided. The long-haired ones in the cold climates of the Northern States are almost entirely of the Angora breed, and these appear to thrive better in such climates than in the warmer climates of the South. Practically all of our long-haired goats not of the Angora breed are in the Southwest, where the climate is usually very warm, having sometime come over the border line from Mexico. So we find short-haired goats in the North, where the climate in winter is unpropitious, and long-haired ones in the South, where the long hair is not necessary to protect them from the cold.

In all probability it will be found by experience that the long-haired milch goats will thrive in all parts of the United States if proper care is given them, and that most of the short-haired varieties will also do as well; but the matter of care is of prime importance, and goats should receive the same rational treatment that dairy cows get.

All goats are alike in their aversion for cold rains and sleet storms, which are detrimental in large degree, and these conditions, where they recur often, must be considered as drawbacks. Goats do not like rain at any time, but in the warm season they are not injured by it.

The ideal locality for goats is one that is high and rocky, with an abundance of vegetation upon which they may graze and browse, but such a high location is not essential. If the air is quite dry, this makes it all the better. The animals do well on level land, provided it is not swampy and is well drained. Soil composed principally of stiff clay, so that the surface water can not rapidly percolate away, should be avoided as an exclusive pasture for goats. However, if the animals can have access to such land with a free run to higher and drier soil, it will not prove altogether objectionable. They will feed largely upon the wet land, but will seek the higher parts for rest and to sleep at night. If given such a pasture their feet should frequently be examined for evidences of foot-rot. Wet soil is more conducive to a rapid growth of the hoofs, which should be kept trimmed. This trimming is done by natural methods where the goats have access to pastures containing rocks and gravel.

A CONSIDERATION OF THE MILK.

Foreign writers almost unanimously agree in their claims as to the value of goat's milk for invalids, for children, and for cookery. Some of them regard it as most beneficial when taken medicinally for certain diseases and ailments. The claim is generally made that it is absolutely

free at all times from the germs of tuberculosis; but this is a matter which will be discussed under another head, since it concerns the animal itself as well as the milk.

There is a considerable number of sanitariums in France and Switzerland where goat's milk is advertised as a prominent feature of treatment. In these places this milk is the principal kind used in the cooking, and the patients are encouraged to drink as much of it raw as they can. The reports that come from such institutions are very flattering to the medicinal worth of goat's milk, yet, in order that too much reliance may not be placed upon this milk generally, it should be remembered that the animals in those mountainous localities must themselves surely be in most excellent health, having, as they do, the purest of air, feed, and water; and the patients, too, are no doubt greatly benefited by the same pure air and water.

The milk is specially recommended for infants because of its similarity in composition to the mother's milk; and the literature is full of instances of success attending the use of the milk with children that, previous to its use, were rapidly wasting away. The writer has in mind several specific instances of the same character which have occurred in the United States. The Milch-Zeitung says, however, that most authors who are assured of the complete digestibility of goat's milk, and who recommend its use above all others, base their opinions on results obtained from feeding children several months old. It is pointed out that the digestibility of goat's milk depends largely upon the action of the salivary glands, and that these glands in infants produce very little, if any, saliva previous to the cutting of their teeth. Whatever there may be in this contention its discussion will be left to the medical fraternity for experimentation. There can hardly be a doubt, however, as to the wholesomeness of the milk for children, the term being used in a general sense.

It is interesting to note here that of all domestic animals the goat is probably the best foster mother. She will readily adopt infants, calves, lambs, colts, or pigs. In some countries infants take the milk direct from the udder, and for this purpose the goat willingly enters the house, says B. R. Haddrup, and seeks the infant on the bed. Haddrup also says that the goats conceive a liking for the life which they nourish, "since they conduct themselves with extraordinary willingness toward the one who takes their milk in the matter of gratifying the whims of the suckling or of the person who milks them." With lambs they will lie down entirely when these can not reach the teats.

Below are quoted some opinions from writers upon the subject regarding the use of goat's milk:

Apart from its medicinal qualities, however, goat's milk is, for domestic purposes alone, far superior to the ordinary milk supplied by dairymen, as all who have tried

it can testify. Boiled and used with coffee it is delicious, giving the latter a rich, creamy appearance, while a few drops in a cup of tea are more than equivalent to a teaspoonful of cow's milk. When used in cakes and puddings its superiority is quickly apparent, both to the sight and taste, imparting a rich yellow color to these articles when cooked, and thereby acting economically by lessening the requisite number of eggs. Its only disadvantage for cooking purposes is its liability to curdle, which it is very apt to do if used rather old. It bears diluting well, and even when mixed in the proportion of half and half is by no means "sky blue."—*Pegler.*

Invalids for whom a milk diet is prescribed will find goats by far the best source of supply, as, besides being better in feeding power, goat's milk is very much easier of digestion than that of the cow, the reason being probably the extreme minuteness of the fat particles. For this reason, also, the cream does not rise so rapidly, and thus the milk contains almost the same amount throughout the day, a peculiarity which, while it is a disadvantage where the making of butter is the object in view, is of great advantage in cases where it is desired to use the milk in its natural state. Cream rises most rapidly in the first few hours that milk is kept; hence, in feeding an infant or invalid upon cow's milk, it will be seen that the cream will be in greater proportion at the beginning of the day, and the food approximate more to skimmilk as the day advances—a variation that may be quite enough to derange an infant's digestive organs.—*Hook.*

It would seem that goat's milk, which has for so long a time been rejected on account of its odor and composition, is about to be used much more extensively. Doctor Marfan has shown that in fresh milk there are certain zymoses which are destroyed by heat. The goat's milk does not contain any more casein than woman's milk, and according to Crepin's analysis the amount of casein and butter is about the same as in human milk. Doctor Boissard, obstetrician of the Paris hospitals, published last year a report on the results given by the use of goat's milk, and the latter were favorable. There is a special establishment in Paris where goats from the French and Swiss Alps are kept. The greatest cleanliness is observed, the jugs being washed in boiled water at milking time; the milkmen are obliged to wash their hands with soap; and the bottles and milk cans are sterilized by being boiled in a solution of carbonate of sodium. It is a well-known fact that the goat does not readily contract tuberculosis, and this, of course, is a guaranty of some importance.—*The Medical Times, May, 1902; Modern Medicine, July, 1902.*

Goat's milk has the advantage over cow's milk of being free from tubercle bacilli, and can be taken quite fresh. Contrary to general opinion, the taste is not disagreeable if the animals are properly selected and properly kept, being considered of a more delicate flavor than cow's milk. The quantity of fats, casein, and salt varies greatly in the different varieties of goat. For infants and dyspeptics the weaker milk may be chosen, while the stronger answers better for debilitated subjects.—*Paris Journal of Medicine.*

Goat's milk is said by physicians here to be freer from the tubercles [germs] and more nourishing than any other milk, and hence is often prescribed for patients with a consumptive tendency. I am told that, except for the above-mentioned qualities, goat's milk is of no greater value than the milk of the cow. In fact, it is stated that the latter, when boiled, is quite as good as the milk of the goat; but, inasmuch as many persons dislike boiled milk, fresh goat's milk is prescribed instead. In French Switzerland—at Lausanne, Vevy, and other places—boys go from house to house with a half dozen goats, supplying milk as it is called for by milking the animals on the premises. * * * The Canton of Appenzell, in northeastern Switzerland, is particularly noted for "Kurorte," whence is dispensed the milk of the cow and the goat.—*Consul-General Irving B. Rickman, in Consular Report, 1898.*

CHARACTERISTICS OF GOAT'S MILK.

Besides the matters of flavor and odor, which are discussed elsewhere, the leading characteristic of goat's milk is the small size of the fat globules. These are so small, according to Voelcker, that hardly any cream rises on allowing the milk to stand at rest for twelve hours or longer. Referring to certain tests, he said: "One of the samples threw up scarcely 1 per cent of cream and two others none at all on standing for twenty-four hours." This condition of the milk makes the ordinary method of separating the cream impracticable.

As to the keeping quality of goat's milk, Pegler says it is not equal to that of cow's milk, but some tests in the United States within the past year showed that there was no more difficulty connected with the keeping of goat's milk than that of cow's milk. There seems to be no reason why there should be anything inherent in this milk that would tend to cause it to "change" sooner than cow's milk; and experiments will probably show that the keeping quality of the milk of goats, as well as that of cows, depends not upon any inherent characteristic of the milk, but upon the cleanliness exercised in drawing it and caring for it.

The color of the milk is nearly always pure white. When a doe is "fresh," or has but recently kidded, there are rare instances when the milk is tinged slightly with a yellow color.

YIELD OF MILK.

The first question that most people ask concerning this industry is, "How much milk will a goat give?" A moment's reflection is sufficient to convince one that this question can not be given a definite answer. Such matters as the healthfulness of the animals, the character of feed, the regularity of feeding, the kind of breed, the age of the animal, etc., have an important bearing upon the quantity of milk produced.

A doe that yields less than a quart a day is not considered a good milker; if she yields 2 quarts a day she may be regarded as profitable, provided lactation may be maintained six or seven months. Pegler says that a doe yielding 3 pints a day with her first kid "need not be set aside as an indifferent animal, as she will, in all probability, give twice that quantity on subsequent occasions." The German literature is full of instances of goats that yield 4 and 5 quarts per day, and it appears that the average in Germany and Switzerland must be not far from 3 quarts. Indeed it is stated by German writers that many goats yield ten times their body weight of milk annually, and exceptional animals as much as eighteen times their weight.

In its form the goat exhibits, as it were, the complete type of a milch animal, and by demonstration gives annually ten to sixteen times its own weight in milk, and

considerably more even, whereas in the case of the cow we must be well satisfied with five times its weight.—*Petersen.*

The milk reaches ordinarily ten to twelve times the body weight, exceptionally eighteen times this weight, in each year. In the case of very good goats, from 4 to 5 liters[a] can be produced for each kilogram of body weight, or, at the least estimate, double what a good milch cow can show for each kilogram of her weight.—*Zürn.*

If we take the live weight of a goat at 30 kilograms (66 pounds) and the annual yield of milk at only 300 kilograms (660 pounds), it will appear that goats yield in milk in one year ten times their live weight. Animals with large milk-yielding capacities can, if well fed, yield annually 800 kilograms (1,760 pounds), or even more.—*Fleischmann.*

Petersen states that one Langensalzaer goat gave 1,800 liters in one year, and that this breed has been known to give a maximum daily yield of 10 liters.

As suggested in the first paragraph on this subject, the matter of quantity depends much upon the breed. Probably the heaviest milker of all the breeds is the Nubian, which is not adapted to most parts of the United States. This breed yields from 5 to 12 liters per day. The Swiss breeds often yield 4 liters per day. Dettweiler publishes the annual yield of twenty-four goats in the vicinity of Altenburg, Geising, and Lauenstein, as follows:

	Liters.
9 gave	600 to 700
7 gave	700 to 800
4 gave	800 to 900
1 gave	900 to 1,000
3 gave over	1,000

Ten animals in the city of Sebnitz were also reported upon, and their annual yield was as here shown:

	Liters.
2 gave	600 to 700
2 gave	700 to 800
3 gave	800 to 900
1 gave	900 to 1,000
1 gave	1,100 to 1,200
1 gave over	1,200

It should be stated in connection with the above results that these goats were not purebred animals, but they had been bred from selected parents, which is true of most of the goats of Germany. This may indicate a policy for us to pursue in this country, where we are not so fortunate as to have many purebred animals; the two instances mentioned below, while no doubt very rare cases, nevertheless show the possibilities in this line.

Col. I. Washington Watts, of South Carolina, crossed an Angora buck upon a common doe, and thus produced a doe that gave "4 quarts of as good milk as any cow on my plantation." Elsewhere is shown

[a] A liter equals, approximately, $1\frac{1}{20}$ quarts, the decimal equivalent being 1.05668.

a picture of Watita (pl. 28, figs. 1 and 2), an American milch goat. According to her owner, "when fresh she was milked three times a day and gave almost a gallon of milk per day of very good quality."

The quotations given above are from authors who write of the best breeds of goats in countries where they have done well for scores of years; but while every condition in the United States seems to be favorable to the milch goat industry, it is possible that some difficulties may be encountered. In England, for instance, the climate is not so well adapted to goat keeping as that of other European countries, and some breeds, indeed, can not exist there. One of the results in England is the reduced yield of milk. Pegler's statement below is doubtless based upon this fact:

I have received positive assurance of full 4 quarts having been reached, but, as I never myself saw a goat that gave a gallon per day, I can not vouch for the accuracy of the statement. The largest quantity I ever obtained myself was 3⅜ quarts, *accurately measured*, the milking being performed thrice daily, and with the utmost regularity. I should state, however, that special feeding had to be adopted to keep up this yield, the animal being naturally a voracious eater, and with an extraordinary fondness for water.—*Pegler*.

Several of the quotations given under this head refer to the body weights of the goats, and the question will arise as to the weights of the different breeds. Wherever reliable information has been available on this matter it has been included in the description of the breeds; but it is a matter of regret that the average weights of a very few only of the breeds are to be found.

COMPOSITION OF THE MILK.

It is not probable that any two analyses of the milk of any breed would agree; indeed, analyses of the milk from one animal taken at different times of the day seldom agree exactly. The ingredients of milk are influenced by the breed, by the kind of feed consumed, by the time of day when the milk is drawn, by the particular part of the milk—whether the first or the last part—and by other minor causes. Therefore any analysis must serve only in a general way to show what the proportionate ingredients may be.

Composition of goat's and cow's milk.

[Œsterreichisches landwirtschaftliches Wochenblatt.]

Element.	Goat's milk.	Cow's milk.
	Per cent.	*Per cent.*
Water	85.6	87.5
Dry substance	.7	.7
Casein	3.5	3.5
Albumin	1.3	.5
Fat	4.6	3.5
Sugar	4.3	4.3

FLAVOR AND ODOR OF THE MILK.

The flavor of the milk of the goat is affected, as is the milk of the cow, by the character of feed and surroundings. The milch goat is generally regarded as a scavenger; and because it is a scavenger and thus able to secure a living and produce milk without expense to its owner, it is kept in foreign countries by those who are unable to provide feed. Most of the milch goats of Italy, of Malta, and of the Orient subsist in this way, and therefore one can easily understand how the notion has become so prevalent that all goat's milk is of poor flavor and bad odor.

The American people understand fully the causes that produce bad milk in cows, and will not expect anything radically different in the goat. If the goats are permitted to roam about the streets and alleys at will and pick up garbage, one may expect to find the milk off in flavor. In European countries the animals supplement their diet of garbage with such weeds and twigs as they can secure by the roadside and on the mountains, and this vegetation consists, to a considerable extent, of aromatic plants and shrubs. All these things have their influence upon the flavor of the milk.

The principal source of the bad odor so frequently noticed in goat's milk is the dirt which falls from the body of the animal into the milk at milking time. This may be very easily understood, and the matter of cleanliness in milking is at once suggested as the remedy. Another common source is the buck, whose skin emits the odor so characteristic of nearly all breeds of goats. Proper care is not exercised in keeping the buck separated from the does that are giving milk. It is specially objectionable to have the buck near during the operation of milking, as the milk readily absorbs the odor.

That milk when produced and drawn under proper conditions is free from ill flavor and bad odor is attested by all those gentlemen who recently imported goats from Switzerland. It is true that there is a natural taste which enables one to distinguish it from cow's milk, but it is not unpleasant.

The remedies for the objectionable features of ill flavor and bad odor lie in the proper feeds and feeding and in the management of the animals. These are subjects which will receive attention elsewhere. However, it seems desirable to quote here some opinions on these matters as expressed by foreign writers:

Many persons are impressed with the idea that this milk has a peculiar flavor, but this impression is entirely erroneous, for when drawn *clean* from an animal in health it resembles cow's milk, both in taste and appearance, the only difference being that it is richer, thicker, and slightly sweeter, containing as it does a larger proportion of sugar and cream and less water.—*Pegler*.

The milk from goats fed upon what an English meadow or roadside yields has no flavor to distinguish it from cow's milk, except, perhaps, its extra sweetness and creaminess; in short, it is only distinguishable by its superiority.—*Hook*.

An aftertaste of goat's milk, according to statements of veterinarians, should not exist, and if any such taste or smell should exist it must be traced to unclean stables or bad feed. Even cow's milk very frequently smells badly under these conditions.—*Milch-Zeitung.*

It [the milk] possesses a singular but not unpleasant sharp taste, the strength of which varies with the feeding and keeping. The better the feed, the cleaner the bedding, the better ventilated the stall, and the more painstaking the care, just so much more pleasing will be the taste of the milk. The goatish taste is always to be attributed to the lack of attention to one or more of these points.—*Dettweiler.*

A scrupulous care of the skin itself is absolutely necessary, even with the best conditions of bedding. If, on the one hand, the pores of the skin, which partly serve to bring air into the body and partly to emit excrementitious materials from it, become filled with dirt and stopped up, metabolism suffers; and, on the other, the materials remain in the body, the proper excretion of which is interfered with. Thus the rather unpleasant aftertaste of goat's milk, for the most part, is to be traced to the fact that the gaseous and liquid excrementitious materials can not pass from the body because of the occlusion of the pores of the skin, and they therefore impart to the milk their unpleasant taste. The milk of healthy and cleanly goats has the same good, wholesome taste that cow's milk has, and excels it in the amount of fat and albumen contained. For these reasons it is imperative carefully to observe the following points: (1) To clean with a brush and comb—first upward, then lightly downward—each day; (2) to wash the goats with soda water or soapsuds on still, sunny days in the spring before turning them out to pasture, and again in the fall before housing them, repeating the operation a few days later in each season; by this means all vermin is destroyed and many skin diseases prevented; (3) to look carefully after the cleanliness of the udder by washing it frequently and with great care and pains.—*Kloepfer.*

It is admitted that goat's milk sometimes has the smell of the buck. Much can be done toward lessening this and toward its ultimate entire removal by furnishing a dry, sweet stall bedded with lots of clean straw, by good care of the skin, and by permitting the continuance as long a time as possible in the open air.—*Zürn.*

PERIOD OF LACTATION.

There are many conditions which have an influence upon the period of lactation, such as breed, individuality, feed, and regularity of milking. Purebred goats yield milk a much longer time than other kinds. This is owing to the fact that they have been bred with a long period of lactation as one of the leading objects in view. It is also true that individuals among all breeds excel in this particular, a fact which is not uncommon among cows. Good feed regularly supplied is a necessity to a long period of lactation, and everyone who has handled cows knows how necessary it is that the milking be done regularly if a full and constant flow is to be maintained. The same principles hold good with goats.

It may be said in a general way that the period of lactation is about seven months. The time may be lengthened in purebred animals by special effort, but with the common goats of this country the time is from three to five months. The reason for this short period is because the goats have not been bred with milk characteristics in view. All

things considered, it is best that the doe be required to kid but once a year. She should not be milked up to the time of kidding anew.

In this country, where the milch goat industry will be largely dependent for its growth for a long time yet upon selected common goats, there will probably be some difficulty in securing a period of lactation exceeding four or five months. Crossbred animals from selected common does and purebred bucks ought to lengthen the period of lactation, as well as to increase the amount of milk. There are now several purebred Toggenburg and Saanen bucks in this country, and, if they are judiciously employed to the fullest extent, their influence for a long flow and a large flow of milk ought soon to be decidedly in evidence.

Where goats have been handled most intelligently in Europe for family use, the plan is to have not fewer than two does for each family. One of these should kid in the springtime and maintain a milk flow for not less than six months, while the other should be so managed as to kid six months later than the first one and also maintain a milk flow for six months. This plan provides for a constant supply of milk, and is specially desirable if there are small children in the household.

THE OPERATION OF MILKING.

The operation of milking goats is not in essential particulars different from the milking of cows, but there are some features about this operation that should be borne in mind, and these will be mentioned here.

In some of the European countries the flock of does is driven through the streets from door to door and the milk drawn by the goatherd in quantity as ordered. This method is not recommended, as its tendency is to cause the goats to "go dry." It is said that the custom has come into vogue because the purchaser distrusts the seller, and that, even when the milking is done before the purchaser's eyes, the goatherd is often requested to invert his milk cup in order to show that it contains no water. The accompanying illustrations show such herds in Malta (pls. 32 and 33). The one who milks draws the milk while squatting behind the goat. This peculiar attitude is taken in milking, it is said, because the animal can not be trained to set her right foot back as a cow is trained to do. The English, however, milk from the side and have no difficulty in doing so.

The goat about to be milked should be placed on a box or table about 18 inches high. If she is given feed here while being milked there will be no difficulty in getting her to come to the box and remain there until the milking is done. Dr. William More Decker, of Buffalo, writing recently of his experience with his imported does, said:

> The does will come to the milking place as soon as the door of their pen or barn is opened, in expectation of receiving their mess of oats. Last summer I milked three

does and each would come in turn as soon as the door was opened. They were given oats in a large measure. The first was allowed to eat until she was milked, when she was returned and the next doe was at the door ready to come out.

Sometimes it happens that a young doe will object vigorously to being milked, and in such cases it has been found necessary to secure the animal by the head. A frequent practice is to use a contrivance called a guillotine fastener, or guillotine board. This consists of two boards with half-round notches, which when placed together fit around the goat's neck. The lower board is fastened securely in position, while the upper one may be moved up and down so as to admit or release the doe. Other methods will suggest themselves to people who are accustomed to milking cows.

Under no circumstances should milking be done in the stalls or in the barn where the stalls are located. The buck should not be in the place where the milking is done, or so near that his odor may be detected, for, as stated in another place, the milk is very ready to absorb this odor.

Regularity of milking should be maintained. When the does are in full flow, they should be milked three times a day; for if not, the udder will become so distended as to be exceedingly painful and the flow will decrease rapidly. A disregard of this point is apt to render futile all other efforts in the way of breeding, feeding, and care.

Kindness and gentleness are now recognized necessities in the best cattle dairies. These characteristics are even more necessary with goats. On this point Von L. Albrect is quoted:

Milch goats will be particularly gentle and of kind disposition when handled and cared for, so far as possible, by the same person. To this end, the milking must be done with regard to gentleness and regularity, and with the closed hand so far as possible. The strokes and tugs must be performed with care. The milking is done best by a stroke directed from above downward.

The following practical remarks by Renesse deal with the general subject of milking:

Before beginning to milk, the two teats are to be washed off with lukewarm water and then dried off with a soft cloth, also the udder is to be stripped a few times from above downward. It is advisable that the animal be milked by one and the same individual, with clean hands, at regular and definite times. The milk pail is to be entirely sweet and clean. Milking must not be done in the stall. Tuberculous persons must not be allowed either to expectorate in the stable or, much less, to milk. That the milk may not depreciate in taste, it should be put away in a suitable place. A statement of the amount of milk given daily should be kept in a book by dates, in liters, in order to have an accurate account as to the profit.

TRANSPORTABILITY OF THE GOAT GIVING MILK.

Another feature about the milch goat that is advantageous is that, in the case of a sick person or an infant traveling, the goat may very easily be taken along on the journey for the purpose of furnishing

milk. This is a frequent practice in England and is not entirely unknown in our own country. This custom will enable a person to enjoy a change of climate and still keep his regular supply of one kind of milk, both of which are conducive to health. It is well known that with infants a change of milk from one cow to another will oftentimes produce disorder in the system, and, of course, it is not practicable to take a cow along, "as one of the family," as the goat can be taken.

If the experience to be gained in the United States shall confirm all the claims made for goat's milk in Europe, there is a suggestion in the above that is worth considering. In the summer season there is an exodus from all of our larger cities of a considerable number of people who seek temporary locations in country places or in the mountains, and among them are hundreds of mothers with infants requiring pure milk and pure cool air. If such resorts should maintain a flock of goats for the benefit of such children—or for other people, if need be—the resulting benefits would be greatly enhanced. Inquiries as to the existence of just such places have been received by the Bureau of Animal Industry, and the idea of their establishment seems practicable.

GOAT DAIRIES.

The question is raised in the paragraph above as to the advisability of keeping goats at mountain health resorts, and here the question will be raised as to the probable value of a goat dairy. Since there seems to be an almost universal indorsement of goat's milk for children and sick people, we may well consider the advisability of the establishment of dairies for supplying the city demand for the milk. Inquiries from physicians of various cities are already sufficient to justify the belief that there is such a demand. The cost of a small dairy need not be very great, and it might be worth the while of physicians to lend such an institution their moral support.

The price to be obtained for the milk will depend largely upon circumstances. In a few instances where some has been sold, the prices ranged from 12 to 25 cents per quart. At this writing the milk of goats in the vicinity of Palisades Park, N. J., is selling for 12 cents per quart. In this case the milk is not used for hygienic purposes, and most likely it is not produced and cared for according to recognized sanitary methods. Better prices will probably obtain where the milk is properly produced for consumption by puny children and sick people.

If such dairies are established and prove successful, other matters of development will demand attention, such as the manufacture of cheese and condensed milk. A few remarks on cheese are given elsewhere, and only a sentence will be given here with reference to condensed milk. Goat's milk in this form is already found in the markets of

Europe, and there can be no question that it will fill a want where it is not possible to obtain the milk in a fresh state. It should supplant entirely the use of such milk from cows, which is now used by thousands of infants during the first few months of their lives.

GOAT'S CHEESE.

It does not seem practicable to include much in this paper regarding the manufacture of goat's cheese. If it shall appear later on, after the establishment of goat dairies, that the manufacture of cheese should be undertaken, the matter will then no doubt be discussed by some one who is familiar with all the processes, which is not the case with the present author. Nothing further will be attempted here than a few general remarks, in order that those who are uninformed on the question may know that the manufacture of cheese from goat's milk is a very important one in Europe.

The cheese that is made from goat's milk is considered very choice and always brings good prices. Some of the varieties quite well known in the United States are the Roquefort, Ricotto, Schweitzer, and Altenburger. It is stated that on an estate near Lyons, France, 12,000 goats are kept in flocks of 40 to 60 for the purpose of cheese manufacture.

The goat's cheese made in the vicinity of Mont d'Or, France, near the Swiss border, enjoys a world-wide demand, and there are employed at this place about 15,000 goats. We are informed that the annual production of cheese there is valued at 1,500,000 francs ($289,500). The French goat's cheeses worthy of special mention are Fromage de St. Marcellin, St. Claude, Cheveretin, Gratairon. The first one is a combination of the milk of the goat and the sheep, which also is the case of most Roquefort cheese.

The strong taste and odor of goat's cheese are qualities very pleasing to many. In Norway a goat's cheese called Hoitcost is quite a favorite. On this account the French, German, Dutch, and Swiss dairymen, especially the last two, have been in the habit of making cheese of an especially pronounced odor and flavor, and, in pursuit of this habit, some of them have used the milk of the goat in part with that of the sheep and the cow in the making of cheese; but while in some instances the milk of the sheep is used wholly for a special kind of cheese, that of the goat is only used when mixed with the ewe's or cow's milk, simply for the purpose of securing the special flavor of it; and, as the special kinds of cheese thus made find a market in our large cities to considerable extent and at high prices, it is quite probable that the making of this kind of cheese may become an established and quite profitable industry; and, in fact, in view of the great enterprise and ingenuity of the American citizen in all the business of life,

it may easily become so to an enlarged extent when goat's cheese shall be offered in our markets.

With reference to the manufacture of goat's cheese, Renesse gives the following:

The milk is treated in a kettle warmed to 25° to 26° R. [or 88° to 90° F.], and, while being stirred evenly, is brought to coagulation by the addition of rennet. By this means the so-called curd is separated out of the whey. The curd is then manipulated with a strainer and the whey allowed to run off. When the curd after several hours has become dry, salt and caraway seed are intimately mixed with it and it is made into small cheeses. These little cheeses are to be placed on racks in the cellar to dry and are turned daily. After about fourteen days they are ripe and ready for use. The cheese takes on an especially fine taste and sweet odor if, after a long period of ripening, it be laid in the dried leaves of the sweet-scented woodruff. As a rule 1 kilogram of cheese can be obtained from 10 liters of milk.

GOAT'S BUTTER.

It is not deemed worth the while or the space to say very much here about goat's butter, for at best it is said to be a very poor substitute for the article made from cow's milk. In the Orient, especially in Syria, goat's butter is frequently but not extensively used. It is served to American and European travelers in that land and they find it almost unbearable. The cream rises upon the milk very slowly because of the smallness of the globules of fat, as has been explained before, and therefore in order to secure practically all of the cream the milk is permitted to stand until it becomes thoroughly soured. Very little effort is made to keep the milk free from dirt, and consequently the long period of setting intensifies the injurious effects of the dirt.

Some of the characteristics of the butter are its whiteness and softness. Very rarely it has a yellowish tinge. The taste is said to be pleasant if made under modern sanitary conditions, yet it is inferior to cow's butter.

Composition of goat's butter.

[Milch-Zeitung, 1893, p. 756.]

Element.	Per cent.
Water	8.2
Fat	86.5
Salts and ash	3.7
Proteids	.9
Carbohydrates	.7

GOAT'S WHEY.

Goat's whey is highly recommended by foreign authorities for its medicinal and nourishing properties. Zürn says it is recommended especially for diseases of the lungs and for anemic persons suffering

from innutrition. As this feature of the milch goat industry is not likely to become a matter of importance in this country for some time yet, nothing further will be given here except an analysis, as below:

Composition of goat's whey.

Element.	Per cent.
Fat	0.02
Sugar	4.969
Salts	.665
Albumin	.581
Water	93.765

IMMUNITY FROM TUBERCULOSIS.

Some writers state with great positiveness that goats are absolutely free from tuberculosis and therefore the milk from goats can not be affected with tuberculosis germs; others state, however, that this claim is too strong to be borne out by the facts. If the claims of the first class were strictly true, it could well be said that the goat would not only be a real boon to humanity but would also be the most useful of all domestic animals. It will probably never be known just how many people contract tuberculosis by drinking the milk of tuberculous cows, but it is well known that the number is considerable. It is quite generally agreed at this time that this disastrous disease is acquired rather than hereditary, and that one source is milk from diseased cows. Renesse says, in discussing the advantages of goat's milk, that "In Germany 100,000 people die annually from consumption, and the number of those sick from the disease is estimated at ten times this number." In all probability the death rate from this disease is just as large in most other countries. If all this be true, surely all efforts are dignified that have for their object the eradication of tuberculosis. If goat's milk is really helpful to the attainment of such an object, it should be given the most extensive use. Milk is the first food of man, and he is dependent upon it, to a large degree, throughout life.

It will not be out of place to suggest here that that freedom from tuberculosis, which is so often asserted, is due to the feed and climate where the animals are found and to the exercise obtained in roaming over the mountain sides. It may be that when confined in close quarters with cows that have tuberculosis the goat will also contract the disease; in other words, its freedom may be due to environment rather than to a physiological immunity.

It is not the purpose of the present writer to enter into a discussion of tuberculosis. That matter will be left to the medical fraternity. The purposes of this paper will be subserved by giving some of the opinions of foreign authors, in order that we may know what thought is being given to the subject abroad.

A German agricultural paper indorses goat's milk because of its "antitubercular properties, insuring a pure milk yield;" and the paper continues:

Since Löbe, Rhode, and others ascribe to goats an almost total immunity from tuberculosis, Koch makes the statement, in his first study concerning tuberculosis due to infection of cow's milk, that recently there are well-authenticated cases recognized in the literature due to inoculation by cow tubercles or in consequence of rearing goats on tuberculous cow's milk.

Hilpert says that since the goat is much more healthy than the cow and sheep, tuberculosis (which can be transmitted from them to man) attacks it very rarely, and so its milk is very much better and is especially adapted to children.

Renesse says, with reference to the milk of the goat, that there need be no "fear as to the transmission of tuberculosis."

Doctor Schwartz, medical counsellor from Cologne, in an address at Frankfurt (1896) before the Association of German Naturalists and Physicians, directed the attention of the convention toward goat's milk as a food for children because goats rarely have a tendency to tuberculosis, and even when they have it they become infected by coming in contact with tuberculous cattle.

While the statement is not entirely true that goats are absolutely immune from tuberculosis, yet of 1,500 goats publicly slaughtered in one year only 0.6 per cent were affected. This bears no comparison to the prevalence of tuberculosis among cattle. For example, in the slaughterhouse at Kiel, Germany, in 1896, 41.03 per cent of all slaughtered cattle and 45.82 per cent of all cows were found to be tuberculous.—*Hoffmann.*

Undoubtedly the most important of all the qualities of goat's milk, especially in its relation to its adaptability to the feeding of infants, is its immunity from the danger of carrying the germs of tuberculosis.—*Hook.*

In the Kingdom of Saxony, according to a report concerning veterinary affairs for the year 1894, it is stated that out of 1,562 goats slaughtered only 10 (0.64 per cent) were found to be tuberculous, of which 2 were destroyed, 1 was kept under observation, and 7 were found salable. In Prussia, in 1899, in 381 slaughterhouses 47,705 goats were killed. Of this number only 148 head (0.41 per cent) were infected, either generally or locally. This result must be the more astonishing because the goats, with only a few exceptions, were kept under conditions eminently favorable to the spread of tuberculosis. Petersen, quoting these same figures, says that the goats ran freely in the cattle sheds, ate out of the racks with tuberculous cows, and, owing to the well-known proclivities for mischief, took hay out of the mouths of the cattle, whereby they exposed themselves to the greatest possible infection.—*Dettweiler.*

Assistant Eichhorn informs us as follows in Report of Veterinary Science in Imperial Saxony, concerning the appearance of tuberculosis in goats: "There was a goat (in a large herd of 28 head) which had been brought for treatment and which after its death, which soon followed, was found to be tuberculous to a high degree. This made it imperative to inoculate the remaining 27 head with tuberculin. In 18 of these, in consequence of the inoculation, a rise of temperature occurred of 1° to 2.5° C., and only in 9 did the increased temperature amount to less than 1° C. (0.6° to 0.9° C.). Because of this result 68 per cent of all the goats had to be retained

on suspicion of being tuberculous, and only 32 per cent were to be looked upon as probably free of tuberculosis. The owner could only make up his mind to have 3 slaughtered, of which 2 were suspected of being tuberculous and 1 was probably free of the disease, the result justifying the conclusion that the diagnosis was correct. This shows that a greater degree of care is necessary in the use of goat's milk as food in the milk cure."—*Deutsch Landwirthschaftliche Presse.*

MANAGEMENT OF THE GOATS.

The buck.—The management of the buck is of the utmost importance if it is desired to conduct the goat business along definite plans. If carelessly managed he will upset all plans. It must be remembered that the male of all breeds of goats, except the Angora breed, is in heat at all times, and that the doe comes in heat about every three weeks, except during the months of July and August. This means that if the buck is allowed to run with the does the kids will oftentimes be coming at the most inopportune seasons, which is not at all desirable. If milch goats are to be kept for family use or for dairying, it is necessary that breeding be done according to a schedule, so that a constant milk supply may be had throughout the year.

Besides the objection to breeding at the wrong season, there is the further objection of breeding the does too often. Usually, if not restrained, most milch goats will breed twice a year, and sometimes it occurs that kids will be dropped three times in one year. This is putting too much strain upon the does, and the best results can not be obtained by the practice.

The buck should always be kept away from the does except when desired for service. By this practice he may be kept in better condition on a less amount of feed than if allowed to run with the does all the time. His presence in the goat barn, especially if milking is done there, is very objectionable. The strong odor which he emits will readily be absorbed by the milk and is the principal source of this odor. His place is in a separate barn and yard and pasture.

Best results are obtained where the buck is always in good condition. It may be necessary to feed him some grain in the winter, but it should not be enough to make him quite fat. He will thrive better and have a more kindly disposition if he is frequently brushed thoroughly.

The doe.—The fact that a doe may be bred to drop her kids at almost any time desired is one of her advantages as a milk-producing animal. If two or more goats are to be kept for household use, it is desirable that there be a constant supply of milk; and, in order that this supply may be produced, the does should drop their kids from four to six months apart.

If a household is to be furnished with goat's milk, matters should be so arranged that this supply may be fairly constant. As one goat

is not capable of furnishing this supply for the entire year, two or three goats should constitute the basis of the household supply.

The matter of feeding is discussed elsewhere, but it should be stated here that goats in lactation should be fed in the same manner that dairy cows are fed. The feed that will produce milk in the one will do the same in the other.

It is surprising how much butting and knocking about a doe can receive without injury even up to within a short time before kidding; but it will always be unsafe to leave the does among the other goats too long after they show evidences of pregnancy. Two or three weeks before the kids are due it is well to shut the does away from the other goats. If she is kept in the barn she should be loose in a pen or box, as shown in figure 44, and kept there until the kids come. Her future handling will depend upon the disposition to be made of the kids. (See "Raising the kids," p. 354.)

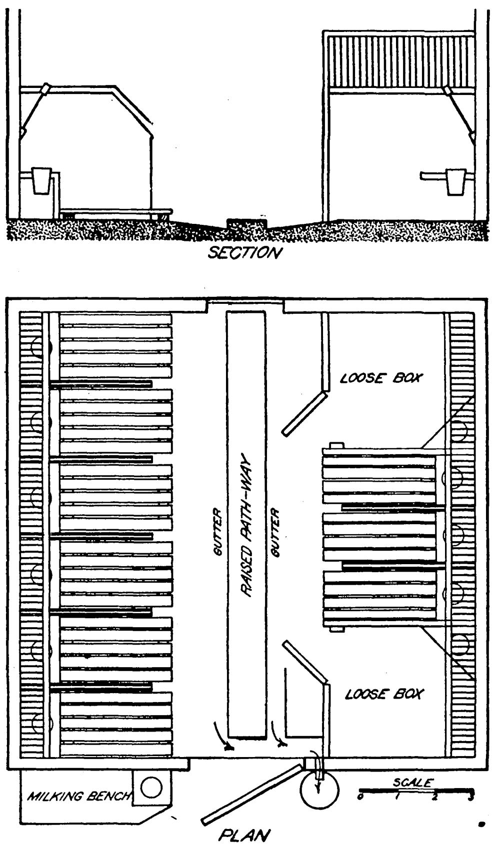


FIG. 44.—Plan of goat house. (Copied from Bryan Hook.)

THE GOAT BARN AND YARD.

The goat barn is a necessity, though very inexpensive expedients may oftentimes answer. No one need expect to obtain a heavy flow of milk from does that are compelled to endure all sorts of weather. Everybody knows this fact in connection with the keeping of dairy cows; how much more should be demanded of a goat? The goat dislikes rain and mud, and will avoid contact with either if possible. While warm rains do not prove injurious, cold rains, sleet, and mud are very detrimental to grown goats and are almost sure to cause death in the very young kids.

The principles that should be observed in constructing a goat barn are the same as those governing a dairy barn. The matter of ventilation is of special importance; for there is no domestic animal that

suffers so much as the goat when it is deprived of an abundance of fresh air. There should be plenty of light, and the sun should be enabled to shine in. If there is an abundance of room for the animals, all the better; crowding is always detrimental.

The better barn is one that has a loft above, where the hay is stored, and this hay can be fed into a manger or rack from above. The rack is better in many respects. The hay in it is easy of access, and not so much of it will be spoiled by the goat as when it is in a manger where the entire lot may be mussed over. Below the rack a board is fitted across the end of the stall, and through this board a hole is made for holding a pail or other similar vessel containing feed. The advantage of this is apparent. This board should be strong, as the animal will use it as a footboard in order to reach the higher for hay in the rack above.

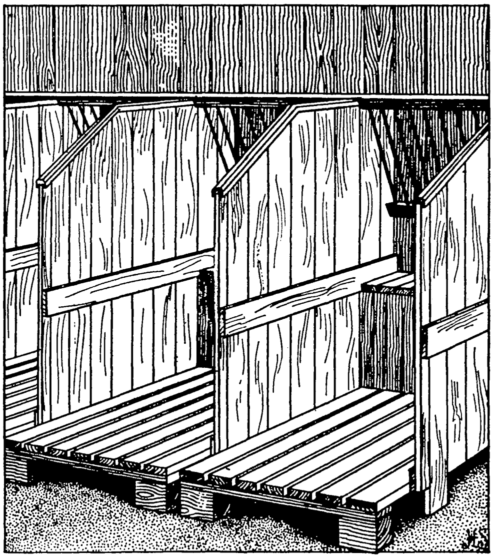


FIG. 45.—Suitable goat stalls. (Copied from Bryan Hook.)

The stalls are usually from 2 to 2½ feet wide, and the partitions between the stalls extend back about two-thirds the length of the goat. This length is sufficient to keep the goats from interfering with each other when feed is given. Each stall should have a floor raised slightly above the earth. This floor should be made of narrow pieces of lumber, and a space left between the pieces so that the liquid manure may pass through and away. It should extend beyond the partition so far that the goat when tied in its stall will not step off.

The illustration given herewith (fig. 45) is reproduced from Bryan Hook, and seems to answer all the purposes of a satisfactory barn. The "loose boxes" shown in the two corners of figure 1 are for the kids or for does soon to kid. Attention is also called to the milking bench on the outside of the barn. If desired this bench may be under cover, but it is always well to do the milking away from the stalls and the other goats. Some goatmen build their platforms in the stalls about 18 inches high and then milk the goat there, but this is not the best plan if it is desirable to obtain milk that shall be free from bad odor and bad taste.

I give herewith a plan of one of my own houses, the arrangement of which I have found to work well. It is designed to provide the greatest amount of accommoda-

tion in a limited space, the inside measurement of the house being 12 feet square. The building is of wood, lined inside, and the intervening space packed with straw and shavings; thus it is seldom that frost can effect an entrance, a point of some importance if it is desired to obtain milk in winter. There are six 2-foot stalls on one side, and on the other three 18-inch stalls, and two loose boxes, the latter to be used for goats that are expected to kid or for shutting kids away from their dams.

The upper part of the loose boxes is made—as are also the hayracks—of ⅝-inch iron bars. Down the center of the house is a raised path with gutter on each side, so arranged that the liquid manure is discharged into a pail, as shown by the direction of the arrows. The milking bench is in the open air, but is protected from rain by the eaves of the thatched roof. This bench will be found a very necessary piece of furniture, for though the animals can be milked in their stalls, the operator will be apt to find the stooping posture extremely irksome. If this bench, about 18 inches high, is placed in some convenient situation and fitted with a manger in which the goat's ration of corn or meal is placed, she will require very little training to mount it willingly the moment she is released, and in this position the milking can be done with comfort. Even a young goat that has never been milked before will learn in a few days to stand quietly, and my friends have often enjoyed a hearty laugh over the alacrity with which each in turn scampers round to the milking bench as its chain is unfastened.—*Hook.*

A good yard should be connected with the barn, where the animals may get air and exercise during the day if they do not have the run of a pasture. It is also a good plan to have an open shed in this yard, where the animals may go to get out of storms or out of the sun's heat. If there are platforms about 18 inches or 2 feet high in the shed and the yard, they will prove a matter of great pleasure to the goats, which will nearly always seek such places when they desire to lie down.

Feeding should not be done in such yards, as the goats will be certain to fight, and it will often happen that serious injury will be done to kids or to does about ready to kid. If all feeding is done in the stalls in the barn, the goats will always be ready to rush in as soon as the door is opened, and each one will go directly to its own stall, where it can eat in peace and at the same time get all that is due and no more.

BEDDING IN THE GOAT BARN.

The goat never seeks the soft places. If given its choice of a place to sleep, it will choose a rock on the highest point in reach. A bed is not one of its requirements, and is in no way conducive to its comfort; but it is desirable that some form of litter be provided, such as chaff or sawdust, for the sole purpose of absorbing the liquid manure that does not pass below the slatted platform in the stall. Straw may be used for the same purpose, but the goat is liable to clear it away by pawing. Sawdust, although a fairly good absorbent, does not make good fertilizer, and it should not be used if the stall cleanings are to be preserved for fertilizing purposes; it is, too, in most places, likely to cost more than other forms of litter.

FENCES.

In opening the discussion of this subject the reader must be assured that the goat is not the worst animal in the world to jump fences, as it is so often charged with being. It may easily be trained to jump a fence of considerable height, but ordinarily it will not attempt to jump a fence that is over $3\frac{1}{2}$ feet high. The goat is naturally a climber, and it will amuse itself in walking the top of any fence that offers an opportunity for it to get there—such fences, for instance, as the old-fashioned "worm" fence, with supports sufficiently slanting to enable the animals to walk up them. If there is just a single place where the goats may climb upon the fence, depend upon it that the whole flock will find it, and never forget where it is.

However, goats can not climb a fence that is straight up and down, neither will they be inclined to jump it; therefore, experience has demonstrated that a fence that is $3\frac{1}{2}$ or 4 feet high is sufficient to restrain these animals. This fence may be made of wire or boards or rails. If it is made of wire, it should be the woven wire, with squares, or meshes, so small that the goat can not put its head through. This precaution should be specially heeded where there are goats with horns, as with the head once through it can not get release without assistance.

The value of any fence for goats, sheep, or cattle is greatly enhanced by a strand of barbed wire about 8 inches above the fence. It tends to discourage all attempts of the animals to get out, and wandering dogs are not inclined to try to go over it.

The fence should be built close to the ground, and care should be taken to see that no opening of consequence is left anywhere, for the goat will crawl as successfully as it will climb, and it often astonishes people by its success in crawling through small openings.

SALTING THE GOATS.

Goats are very fond of salt, which serves its purpose best when given properly. While some prefer to provide loose salt at regular intervals, the usual practice is to place a lump of rock salt in a place easy of access, where the goats help themselves whenever they desire to do so. If goats are accustomed to the use of salt, they will not take too much of it; but, like other ruminants, they are likely to overdo matters if they have free access to an abundance after a period of deprivation. The writer has in mind instances where Angora goats have been killed by a too liberal supply of salt after having been deprived of it for some time.

WATERING THE GOATS.

Goats are not regarded as very great water drinkers, but when in milk they should be enticed to drink as much as possible. The water must be fresh and pure, else it will be avoided by the goats until thirst compels them to drink it. In the winter season it will be well to give it slightly warm.

CARE OF THE HOOFS.

Where goats have access to a pasture containing gravelly or rocky soil, their hoofs will be kept worn down by natural processes; but where they are confined in barns and small inclosures, the hoofs will grow to great length, and will interfere to a considerable extent with the movement of the animals. In this condition the hoof will catch and hold between the toes a large amount of dirt, which makes the parts sore, and more subject to foot-rot than when the hoof is in good condition. It is not difficult to keep the hoofs in proper condition, and, since it is necessary, it ought to be done.

FEED FOR MILCH GOATS.

All of the foreign writers on the subject of milch goats devote considerable space to the methods of feeding and kinds of feed, but, owing to the very different conditions prevailing in this country, their experiences can be adopted in a general way only. The principles governing the feeding of milch goats are the same as with dairy cows.

It will be very natural for those people who have been reading about the Angoras and their ability to destroy worthless brushwood and weeds to think of the suitability of such places for milch goats. These goats have the same appetite for twigs, bark, and weeds that the Angoras possess, and such feed may be regarded as desirable for growing animals, but when the does are in milk a sole diet of such feed is very likely to impart an unpleasant taste to the milk. Besides the unpalatability of the milk from such feed, so large a flow can not be expected as when grain in some form is fed in addition to the browse. The milch goat is a single-purpose animal; she can not produce milk satisfactorily and at the same time destroy brushwood and weeds to a large extent.

Pasturage is highly recommended by the English goat men when the pasture is large enough to really afford a change of diet, but they agree that a small pasture—such, for instance, as an acre for two or three goats—is very undesirable. They say that it is their experience that in such small pastures the goats are so often passing back and forth in their former paths that they tire of the feed and will soon show a lack of thriftiness, and death follows in a year or two. The goat prefers to wander over a large area and to gather its food in a

variety of bits here and there, and therefore a large pasture is quite desirable. However, what has just been said about such feed as a sole diet must not be overlooked.

It is a common statement that eight goats will subsist upon the amount of feed required for one cow and at the same time yield a good flow of milk. Many actual tests made in Germany are cited to prove this. Where browse is afforded as a supplementary feed 300 pounds of hay is a sufficient quantity for a milch goat annually, but in an examination of experiments where large milk production was the object in view it has been shown that some goats will consume as much as 700 pounds annually. It will be well for Americans to estimate the amount required at 500 pounds at least, since we are not so careful to prevent waste as the people of Europe. If permitted, goats will waste much hay by pulling it down underfoot; and as they are very particular about their food, they will eat nothing that is soiled or tainted.

Without hay or good, dry fodders goat keeping for milk is scarcely possible; this class of feed can not be displaced by any other. Good hay, such as the goats relish, is preferable to coarser fodders. Clover hay probably has no superior as feed for goats. It exercises a stimulating influence upon the digestive organs and serves as an active element in the production of milk. Fresh hay, which has not undergone the sweat, is difficult of digestion and easily induces bloating. Old and musty hay becomes repulsive.

Such roots as mangolds, carrots, swedes, Jerusalem artichokes, parsnips, potatoes, and turnips are regarded as excellent feed. The goats prefer the turnips. All roots must be washed perfectly clean. A common method of feeding in England is to cut the larger roots into halves and place them with the cut surface uppermost in the bottom of a pail. The goat will then work at the pieces until all the inside is completely eaten, leaving the rind. The animals seem to enjoy doing this work. It is advised not to feed the mangolds earlier than Christmas, as when fed soon after they are pulled they are likely to produce scours.

Elsewhere, under the head of "Flavor and odor of the milk," there is some discussion of the influence of garbage upon the milk; but those remarks apply especially to that garbage which is decaying and filthy and which is eaten by the goats because of necessity rather than from choice. Clean and fresh refuse from the kitchen and table, such as potato and turnip parings, cabbage leaves, and crusts of bread, are readily eaten.

In feeding grain the same judgment must be exercised as when it is fed to dairy cows. It must be of the proper kind and not fed in such quantities as to produce fat rather than milk.

Bran is considered a most excellent feed, but its use, of course, will

depend upon its cost. The daily ration of this feed will vary between one-half and three-quarters of a pound. It will be well to dampen the bran with a little salt water. Malt is recommended by some, where it can be had regularly and at reasonable cost. It is an excellent milk-producing feed, but it should never be fed sour.

Oats are specially good for goats that are dry and for kids. From one-half pint to one pint a day will be sufficient. Corn is preferred by Pegler for goats in milk; not over a pint a day should be given. He says that when it is mixed with pease or beans it forms capital food. Corn is the most abundant grain feed in the United States, and therefore ought to be of great assistance in the development of a milch goat industry. Meal, oil cake, and linseed cake are highly favored. Of the latter Kloepfer says: "It is absolutely invaluable before delivery, when, on account of its digestibility and ready assimilation, it is a prophylactic against milk fever." In giving oil cake and linseed cake, it should be broken into small bits.

Some remarks on the feeding of various substances are copied herewith from foreign writers:

From my experiments, which I have conducted in the past two years upon my experimental animals, one must figure on at least 3 hundredweight of hay yearly for each mature animal. If one can obtain more, of course it is so much the better. As a means of saving the hay it is suggested that it be cut up and be fed in a narrow rack and mixed with straw. By this means the animals will be prevented from tramping the feed under foot. It is best in the morning to feed half of the day's ration of hay, mixed with equal amount of straw, and after this to give water which in severe weather has been allowed to stand in a warm room or in the kitchen. The offal from the kitchen serves as the usual noon meal, which should be given not with, but without, a large amount of liquid.—*Kloepfer.*

Hay is best supplied in its entire state, but may be cut up into chaff and mixed with the provender. As, however, this requires the use of a chaff cutter, which it is not worth while to purchase merely for goats, it will be generally given as hay and not as chaff. Bulky food like this serves the purpose of filling the stomach, which requires a certain amount of distention to enable it to perform its functions properly. To effect this with corn alone would, in the first place, be expensive, and, secondly, so large a quantity of concentrated food would be injurious. In fact, hay or chaff in conjunction with corn may be regarded in the same light in the diet of a goat as bread and vegetables combined with meat in that of man. There are two kinds of hay—meadow hay, composed mainly of grass with a few herbage plants, and clover hay, made with that plant alone. The latter is generally preferred by goats, but the former is considered best for milch goats, besides also being cheaper.—*Pegler.*

It seems to be the general practice to house goats during the night and, except in the middle of summer, it is probably best to do so. They will need some food during the night—a small armful of grass or some leaves, while, if they are in milk, a few oats, say half a pint, will be an advantage. Kids should have some oats every day if they are wanted for stock. In the winter some linseed cake is of great use, and roots will have to be used—carrots, swedes, and mangels; the mangels ought not to be used before February or March. The tops are good food. All roots should be washed. A certain amount of hay must be given, but in small quantities at a time or it will be thrown down and wasted.

In stall feeding the food will be much the same. It is best given in three meals, at regular times, but the food should be varied as much as possible. This change is of great importance. A moderate-sized garden will supply most of the food required for one or two goats in the shape of waste products, such as the thinning of carrots and turnips, the spare young cabbages for which there is no room, the lettuces that have bolted, any weeds and hedge clippings, together with potato and apple peelings and dry crusts of bread from the kitchen, all kept very clean.—*Soames.*

Opinions differ as to the proper time to feed. Some favor two times a day and others three times a day. The best results from hay are when there is an abundance, and there should be some in the rack at night.

CONCERNING DISEASES OF GOATS.

It is said by those who write from experience that goats are not subject to so great a variety of diseases as sheep, but those diseases which do attack them are in the main the same as attack sheep.

For various reasons, principally because of the limited experience with goats in the United States, it is deemed wise not to enter upon a discussion of diseases that might occur. Most farmers know quite well how to handle animals with minor troubles, but conditions that become serious should call for the services of the veterinarian.

Let the owner of goats keep ever in mind that prevention of disease is nearly always easier than a cure. Given a healthy goat, provided with good feed and water, plenty of fresh air, and proper housing, we have the conditions that do not tend toward disease.

THE MATTER OF BREEDING.

The buck.—With milch goats, as with any other breed of domestic animals, it is very essential that the best buck possible should be employed. Not only should he conform to the recognized type for his breed, but it should be ascertained whether he is from a strain having well-known milking qualities. If his sire is of the proper breed and his dam a good milker, the chances are that he is a good animal from which to breed. In fact, records of the amount of milk given by the dam, granddams, and other near female relatives of bucks should be available and the selection of males should eventually be based largely on this evidence. These records are not difficult to make in flocks which are being carefully bred. There is nothing so important in breeding as evidence that the whole family is good in performance. Always avoid what are usually referred to as "common" bucks.

The number of does to be served will depend very largely upon the management of the buck. His age and constitution, as well as the character and quantity of his feed, have an important bearing upon his powers of reproduction. If the buck is allowed to repeat service several times for one doe, it is apparent that a smaller number of does

can be served than if there is one service only. When carefully managed, one buck is sufficient for a flock of fifty does.

The following description is from Pegler:

A he goat should have a small neat head with plenty of beard and neck short and thick, with abundance of hair. The horns may be large, but not too coarse and heavy. The chest should be broad and massive, the back long and straight, and the ribs well rounded, the tail being placed high up on the hindquarters. These are required to be as square as possible, the reverse being the most common failing of he goats. The legs must be straight, thick, and strong, and well covered with hair on the thighs and buttocks.

The doe.—In a measure the same characteristics possessed by the buck should be prominent in the doe. She should be of a milking strain and at the same time have the other recognized qualifications for milch goats. For convenience most foreign breeders prefer hornless goats of solid colors, but while horns and long hair may be regarded as nuisances, these features really have no influence upon the quality or quantity of the milk. It is obvious that an animal with short hair is more easily kept clean than one with long hair.

The animal should present a lanky appearance, with broad muzzle, clean-cut head, graceful neck, large in the stomach. The chest should be deep and broad and the height should be equal at the shoulders and the hips. The udder is hard rather than soft and fat. Sometimes a fat udder is mistaken for one of large milk capacity. The size of the udder varies with the length of time since kidding and also with the number of times she has kidded. It is not uncommon to see the does of pure breeding have teats that touch the ground as they walk about, especially among the goats of Malta, Spain, and India. Occasionally there are found individuals among common or crossbred goats that have udders that nearly approach this size.

The following description is by a German writer of much observation and experience:

In a good milch goat the following points are to be described: A long body, growing larger at the hinder parts and beneath, neatly rounded form, a deep and broad breast, short legs, broad buttocks, wide but filled out "hungry hole" (the depression in front of the hip bone), a neck that is not too long nor too thick, a light, broad head, wide mouth, and good udder. The udder should be of considerable size. Only those goats can give plenty of milk which have a bulky, well-developed milk gland; that is, a large udder. But it is not always the case that a capacious udder signifies a high milk yield. The amount of glandular tissue in the udder can be augmented by the surrounding flesh and fat, and then the udder is spoken of as a fleshy or fatty udder. A large udder is, then, a favorable sign of an abundance of milk when it is a genuine udder. A fatty udder feels soft and full; its skin is generally somewhat thicker, sparsely covered with long, coarse hair; does not wrinkle after milking and diminishes only slightly in circumference. A genuine milk udder feels tight and as having kernels in its upper portion; its skin is thin and tender, covered with short fine hair, and forms very perceptible folds and wrinkles, which fall together after the milking is done, if the condition of the udder is not too tense.

Moreover, the blood vessels course along very noticeably on account of the thin skin when the udder is filled—a condition not present in the case of a fatty udder. A good milch goat should have a fine, thin skin, which is best examined over the ribs, and it should be covered with fine (not bristly), smooth, glistening hair. That the absence of horns posseses an alleged influence in making the milk mild in taste has been spoken of before. When all these characteristics coincide it is certain that one is dealing with a good milch goat.

THE BREEDING AGE.

There is probably no other domestic animal that is liable to breed so young as a goat; but, as with other animals, to permit very early breeding is to dwarf the doe, and consequently render her almost useless as a good milker. If a doe is bred at the age of 1 year she will drop her kids five months later, which is young enough if the purpose is to produce a good milker to last through several years. A buck may be put to light service at the age of 1 year, but results are more satisfactory if he is not bred till from 18 to 24 months old.

The period of gestation in the doe is about five months (from 147 to 152 days), the same as with sheep. They come in heat at all times of the year, but not frequently between the first of April and the last of August. The presence of the buck has its influence upon the appearance of heat. The doe is in heat in season about every three weeks, and the period lasts from one to three days. The signs are unmistakable, and the owner can use his judgment as to when to breed.

THE TIME TO BREED.

The information just given above shows that the owner of goats may, in a general way, choose his own time for breeding. When goats are kept for family use, where a supply of milk throughout the year is desirable, a practice is in vogue of so arranging the breeding that some of the does may drop their kids at one time and others about six months later. It is only by such a method that one can expect to have a constant supply of milk.

NUMBER OF KIDS AT ONE BIRTH.

The usual number of kids at one time from milch goats is two, but instances are not rare where there are three. Mrs. Edward Roby, of Chicago, has a doe which at one time had four kids and the next time three. A picture of this goat is shown in plate 28, figures 1 and 2. There is a record of a Nubian goat which dropped eleven kids within twelve months—four on each of two occasions and three at another.

Whether the doe shall be required to raise so many kids—or even one, for that matter—will depend upon circumstances. If the breed is exceptionally good and the kids therefore worth more than the milk, it is obvious that the kids should have first consideration.

RAISING THE KIDS.

If the sire and dam are of pure breeding, or have been selected from nondescript stock because of their milk characteristics, it might be profitable to raise the kids, but with ordinary animals the most economical plan is to kill the male kids as soon as born or as soon as they are old enough for use as meat. The object in view in keeping the female kids is milk production and flock increase; if their breeding promises nothing in the matter of milk production, which is likely if the sire happens to be of poor quality, they, too, should be slaughtered.

All things taken together, the advisability of raising the kids depends upon "dollars and dimes," and this is a matter that each breeder will be able to decide for himself better than anyone else can do for him.

In European countries goat's milk always brings a higher price than cow's milk, and because of this fact kids are often raised on cow's milk. This is not a difficult thing to do. An ordinary nursing bottle answers the purpose fully until the kid is old enough to drink. There might be some danger in this method of raising the kids if the milk should happen to come from a tuberculous cow, for it is possible for goats to contract tuberculosis, notwithstanding the statement so often made that they are absolutely immune from it; and there is no other method known, except inoculation, more likely to communicate the disease. If the cow furnishing the milk is sound, this method ought to prove very satisfactory.

If a nursing bottle is brought into use it should always be kept clean. Particles of sour milk, that otherwise will collect in the nipple, will clog the opening, and very often produces sickness in the kid.

So soon as the kids are old enough to eat they should be allowed some green feed. If leaves of trees or weeds are available the kids will snip them off, and thus secure a mixture of diet, which is quite essential; for goats of all ages soon tire of one kind of feed if it is given without change. A little later the kids will begin to eat grain. Oats are generally considered the best grain for the growing animals, although other grains, when fed with judgment, give satisfactory results.

The time for weaning will depend upon the value of the kids. Assuming that the kids are sucking, because they are worth more to the owner than the milk, they should not be weaned until they can do just as well or better on other feed. This time will be not less than three months from birth, and not over four months.

A kid is one of the most delicate animals known until it is two or three weeks old. It is frequently said by sheep men that "almost nothing" will kill a very young lamb; less than that will kill a kid. It must be kept dry, be kept warm, and be well nourished. A cold rain

upon a young kid is about as certain to produce death as a bullet through its body. Angora goat raisers find it very necessary to ascertain from the first whether the kids are getting nourishment in sufficient quantity, as the milk-producing qualities of that breed are uncertain; but with milch goats this condition should not arise. However, it is better to keep close watch for a few days in order to guard against any mishap. After the kid is two or three weeks old it begins rapidly to develop a hardy nature.

IN-AND-IN BREEDING.

By in-and-in breeding is meant the mating of individuals that are closely related to each other. This practice is one which the careless breeder is very likely to permit or possibly encourage, but he should know that, except in skillful scientific hands, it may result in goats of weak constitutions. If we are to have a hardy race of goats in this country we must avoid everything of whatever nature that has a tendency to weaken the constitution of the animals. One of the evils from which the Angora goat industry is now recovering was the in-and-in breeding that was extensively practiced until a very few years ago. Let the milch goat breeders profit by that mistake.

The purpose here is not to condemn in-and-in breeding altogether, for it has in some cases proved to be of great benefit; but its success depends so much upon a thorough knowledge of the principles involved—information which is not possessed by the great majority of breeders—that goat men are advised to avoid the practice. Some families of goats, as of other breeds of live stock, will endure in-and-in breeding better than other families. A family of strong milking goats, which will thrive under close breeding, would be especially valuable, because it could be multiplied pure without injury by the admixture of blood less efficient in milk production. Such blood would be useful as purebred milch stock, and the males would be likely to be prepotent sires to use in improving the remainder of the breed or in grading up from common stock.

HARDINESS OF GOATS.

The goat is a hardy animal; but it must not be understood by this statement that it is capable of withstanding all of the hardships for which it is so frequently given credit. In a playful way the press writers and cartoonists picture the goat as being always thrifty upon a diet of posters and tin-can labels, and show it in great happiness in a vacant lot that is entirely wanting in weeds and other vegetation. It is surprising but nevertheless true that some people believe such stories, if one may judge their beliefs by their actions. Thousands of Angoras have been starved to death in inclosures—so-called pastures—where there was practically no feed whatever. Apparently the animals

were expected to gnaw the bark from trees large enough for saw-logs and to gather leaves and twigs at a height of 10 feet and more.

The hardiness of the goat is ascribed to various causes, such as the large amount of exercise and fresh air that it gets in gathering its food, the great variety of food that it secures in thus wandering about, and its practical freedom from tuberculosis consequent upon the above conditions; but it can not maintain this hardiness without exercise, with little fresh air, or with little feed, and that of one kind only. There must be also a good shelter from storms easy of access at all times, and protection against extreme cold must be afforded in winter. Under the conditions first named in this paragraph the goat is likely to remain healthy; but it should not be assumed that it is not subject to disease. The same precautions should be exercised toward it that are accorded sheep.

After an experience with goats of various breeds, extending over a good number of years, I have been forced to the conclusion that these animals, under the conditions in which they are usually maintained in this country, are not the hardy creatures they are popularly supposed to be, and which I myself at one time thought them. No doubt in a wild or semidomesticated state on the rocks and mountains where they love to roam, and where they obtain the kind of food best suited to their requirements, these, like most other animals under similar circumstances, rarely suffer from disease. But housed in overheated and badly ventilated stables or pastured on rich, moist soil, this hardihood no longer exists, and goats become subject to some of the diseases common to sheep and cattle.—*Pegler.*

POINTS TO BE OBSERVED IN PURCHASING GOATS.

Aside from the technical points governing the selection of a buck or a doe, there are a few others that are worthy of consideration and they are discussed here.

If a registered goat is purchased, both the seller and the purchaser should be anxious to see that the transfer of the certificate is properly recorded with the registry association. This is usually done by the purchaser after the seller has turned over to him the certificate which he holds. The purchaser should insist upon this action. He should also obtain from the seller a copy of the pedigree of the animal. Of course, right now, when registration is just beginning, a pedigree will necessarily be very short, but the purchaser should have what there is of it. It is not necessary to discuss the value of pedigrees, but live stock men all know how important a pedigree is.

An animal is not necessarily a good one because it is registered; but its registration indicates that its sire and dam have been bred along right lines, and the chances are that it will be useful for the purpose for which it is bred.

There are some advantages in purchasing an old goat, say 5 or 6 years old. She will know better than a young one how to care for her kids; she will have become accustomed to the milking operation,

and probably she will give a larger quantity of milk than a younger animal. Besides, if a goat has once given milk, one has a pretty fair index of what she will do in the future. The purchaser should be on the alert in order that a goat may not be sold to him that is so old as to have passed all its days of usefulness. The teeth will show the age until the animal is 5 years old, but after that, in the absence of authentic records, dependence must be upon the judgment based upon general appearances. The condition of head and eyes indicates old age better than any other features. A goat is not to be considered old because it is thin in flesh, for this condition is a prevailing characteristic among milch goats. It is next to impossible to put any fat on one that is giving milk.

The purchaser should insist upon healthy animals. If he should get one that is sick he not only stands a chance of losing it, but the sickness may spread to all the others of the flock and finally result in total disaster. This would be especially true of the disease known as takosis, which is described in Bulletin No. 45 of the Bureau of Animal Industry. The animal selected should show spirit in eyes and ears, give evidences of plenty of blood, and be a hearty feeder. Condition as to fatness should not have much weight, but make sure that the thinness is not due to poor health. Ordinarily the bucks may be expected to carry more flesh than the does.

PRICES OF MILCH GOATS.

So far there has been very little dealing in milch goats in the United States, and therefore no really definite price. It is evident there will be as many different prices as there are different kinds of goats. The common American goats can be purchased at this time, if one is so fortunate as to find them, at $2.50 to $10, while no prices have been made upon any of the purebred animals. The basis of the price to be paid must depend upon the value of the animal to the purchaser, and in such a case the purchaser himself is the best judge.

The best milkers of Malta sell at $18 to $25, while the various breeds of Switzerland bring about $20 each. In Syria and Egypt they may be had for a price as low as $4 each. In England prices are very much higher. A very fine milker in the latter country will sometimes bring as much as $40; if a pure Toggenburger, the price is more apt to be $100 or more.

WHERE TO PURCHASE GOATS.

"Where can I purchase milch goats?" That is the question that has often been asked of the Bureau of Animal Industry, and it will probably be repeated a thousand times more. The difficulty is that a definite and entirely satisfactory reply can not be given; but it is proposed here to give the best information at hand for the benefit of pros-

pective purchasers. At this time, right at the beginning of a new industry here, it is, of course, not expected that there are anywhere large flocks to which correspondents may be referred; and if such flocks are brought together very soon they must necessarily be of the common stock. With only about a score of purebred does in the country at this time we can not hope for a sufficient number of kids very soon to supply the demand for animals of pure breeding. It is the purpose of the owners of these purebred animals, however, to keep the blood pure through the imported does and to use the pure bucks to the fullest extent practicable upon selected American does. This method should soon produce a considerable supply of grade kids of considerable value.

It is obvious that for a time those who desire to purchase milch goats will have to depend principally upon the common American stock, and these animals will be found generally in the suburbs of the larger cities, where sometimes as many as half a dozen may be found in a flock. In the Southern States a considerable number will be found here and there on farms, especially upon those farms tilled by colored people.

Occasionally there are Angoras that give a large quantity of milk, but they are not numerous. The milk of the Angora is equal in quality to that of any of the milch breeds, and some analyses indicate its superiority over all of them.

LENGTH OF A GOAT'S LIFE.

Goats have been known to live to be 16 years old, but such instances are rare. The average length of a goat's life is probably about 12 years; and, in the case of does, if they have been well cared for during all of their lives, they may produce kids until that age, but the ability to produce milk is greatly diminished. Under the ordinary conditions of goat raising, an animal is in her prime when from 5 to 7 years old. If one should possess an exceptionally good doe, one which transmits her good characteristics to her offspring, he would have a doe worth his while to keep till old for breeding alone.

The buck's period of usefulness depends more largely upon his care than that of the doe. If not managed with good judgment, his vitality is liable to be exhausted before he becomes very old. If he is kept vigorous by good feed and put to service rationally, he should be yet a good getter at 10 or 12 years of age.

HOW TO DETERMINE THE AGE.

It is not a difficult matter to determine the age of a goat until after it is 4 years old. The accompanying illustration (fig. 46) from Bryan Hook is very helpful to an understanding of this matter. During the first year of a kid's life its teeth are small and even and sometimes separated, as shown in the illustration; the second year shows the two

front teeth as being much larger and higher; the third year adds two more large teeth; the fourth year, two others; and the fifth year, two others yet, which completes the set. After this time the only way to know a goat's age is from records that may have been kept; but one may form some judgment of its age by its general appearance.

GOAT'S FLESH AS FOOD.

There is a prejudice in most countries against goat's flesh as food. This is the outgrowth of experience with common and milch goats, the flesh of which, from mature animals, is tough and often of strong flavor. In some parts of Asia, especially in Asia Minor and Syria, the goat, however poor its flesh may be, is the only economic source of fresh meat, and many are used there in this way.

The kids are everywhere considered a table delicacy. There is in the meat none of the unpleasant features of that from the older animals, and it is generally said to be superior in flavor to lamb. They should be slaughtered for eating when from one to three months old. A correspondent of this Bureau, in writing of the goats kept in the Italian settlement at Palisades Park, N. J., states that the kids, when dressed at eight weeks old, sell readily at $3 to $5 each. Of course, this locality is near the largest and best market of the country, but the delicacy of their flesh ought to insure a ready market anywhere.

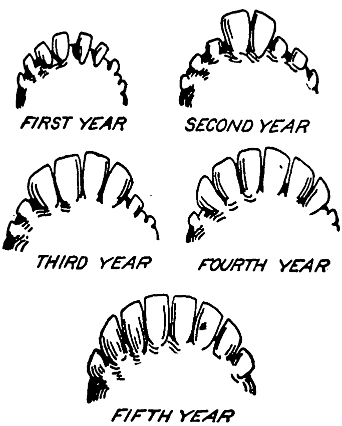


FIG. 46.—How teeth show the age of goats. (Copied from Bryan Hook.)

THE SKINS.

The skins of milch goats are of better quality than those of the Angora breed, and are the kind used in the manufacture of shoes and gloves, and those from the colder parts of the country are better than those from the warmer parts. Inasmuch as the United States imports millions of dollars' worth of goatskins annually, it would seem that there should be a ready market for all that might be produced here. It is estimated that the skin from a kid of two months is worth when dry about 25 cents.

Probably most people who handle goats know how to care for the skins, but for the benefit of those who may desire information on this point the following is copied from Pegler:

The operation of flaying should be performed as soon after the death of the animal as possible, for if it be delayed any length of time the hide may deteriorate in quality; this is sure to be the case if the goat dies from disease and has been left until decompo-

sition has begun to take place. To remove a skin properly requires some skill and care, so as not to cut it with the knife, and at the same time leave as little flesh and fat attached to it as possible. Those who are inexperienced in such work had better employ their butcher's slaughterman, who for a trifle will kill, flay, and cut up their goat in a workmanlike manner. When the skin has been taken off, all the bits of flesh and fat adhering to it should be carefully removed with a knife, and the hide placed to dry, the hair side inward, in a covered, airy place free from damp. To prevent it from shrinking the head and tail ends should be stretched out and nailed on a board, and the leg parts spread out with skewers. Skins are sometimes preserved with salt and dried afterwards, but salt should not be used where it is intended to convert them subsequently into leather, as it never becomes thoroughly eradicated. The process of salting consists of laying the skins flat on the ground and well sprinkling the flesh side with salt and alum, more particularly on the edges and spinal portions. They are then folded by being doubled, first lengthwise down the center, and then one fold over the other until a square is formed; they will keep good in this manner for a considerable time, and may be dried afterwards.

MILCH GOATS AS BRUSHWOOD DESTROYERS.

The pronounced habit possessed by Angora and common goats of eating brushwood and weeds in preference to any other feed is well known, and the thought will doubtless occur to many people that milch goats have the same predilection; and, indeed, they have. Whether or not brushwood is the best feed for them is a question that should be considered. German writers on the subject of milch goats discourage the practice of some of allowing the goats to browse largely upon brushwood. They contend that the twigs and leaves not only have a tendency to impart an unpleasant flavor to the milk, just as in the case of cows, but lessen the milk supply and shorten the period of lactation. In foreign countries the goats wander along the roads and up the mountain sides and gather whatever feed may be accessible, but only a small percentage of their food is brushwood.

In this country the case will probably be that the feeding grounds will usually contain some brush and a small amount will hardly do harm; on the contrary, a little brushwood browse will serve as a tonic and thus help to ward off disease. The act of browsing furnishes exercise—something which is an absolute necessity. However, it would not be well to place goats giving milk in pastures where they can have their fill of leaves and twigs, even if the temptation to do so is strong. Milch cows are not profitable under such conditions, and there is no reason why goats should do any better than cows. There are always kids, however, and the brushwood pastures would prove a most excellent place for them; there they would thrive under the most favorable conditions.

The proper feeding of milch goats is discussed elsewhere in this article. (See p. 348.)

THE MATTER OF FERTILIZER.

It has been estimated by careful observers that the value of the manure produced by one sheep, in regions where manures are purchased at commercial prices, is $3.30 per year. There is no special difference between the manure of the sheep and that of the goat, except that the latter animal produces more of it. But it will depend upon circumstances whether this average of $3.30 per head is actually realized. If the goats remain upon rocky hillsides or in a stony pasture both day and night, very little good will result from the fertilizer; but if they are confined in a house at night or in a small inclosure where the manure can be collected and saved, or if they run upon land that is later to be used for the production of vegetables, grain, or grass, it will prove to be very valuable. The influence of a very few animals is felt over a considerable area of land. There is a permanency in the effect of such manure upon the land that can not be obtained from commercial fertilizers, yet many farmers waste barnyard manure and pay high prices for the latter.

Angora goats have been given much well-deserved credit for destroying the brushwood and weeds upon valuable land and at the same time depositing upon the land a good coating of fertilizer. This clearing and fertilizing, aided by the sun's free access, have caused fields of blue grass to spring up where only weeds and bushes grew before. Milch goats will not do less if the opportunity is afforded them. But it must be borne in mind, as elsewhere mentioned, that much browsing is likely to have a bad effect on both the quantity and the quality of the milk.

HORNS OR NO HORNS.

Some German writers make strong claims, without specifications, however, for goats without horns, but a study of the matter seems to show that as between the horned and hornless varieties there is no difference in the amount of feed required or in the quality and quantity of the milk produced. The hornless varieties are not so likely to do injury to each other when running in flocks as those bearing horns, and in this respect are desirable. It is the opinion of this writer that the presence or absence of horns has no influence upon the value of the goat as a milk producer, but it is granted that the horns are a nuisance and of no value to the animal except as a weapon to be used against dogs. In forming new breeds or subbreeds it might be found, not only possible, but very desirable to breed hornless types.

WATTLES ON THE NECK.

The processes, or appendages, two in number, attached to the under side of the neck of many goats occasion no little comment regarding

their significance. Some have a notion that the presence of wattles indicates pure breeding or a large infusion of pure blood. This is not the case, however, as many of the most useless common goats have them, while some purebred milch goats do not have them. Wattles are not confined to goats. Many people are familiar with a peculiar kind of hog which was numerous in the Indian Territory twenty or more years ago that had wattles very much like those on the goat. So far as the writer knows these processes signify nothing and have no function.

WORRYING BY DOGS.

Dogs do not worry goats to the extent that they do sheep; but the failing is not with the dogs. The goat is better able to take care of itself and is more inclined to do so. However, it will never be entirely safe to expose kids where there are worthless curs in the neighborhood, for this is the class of dogs that usually worries sheep. It is not often that a well-fed dog of good blood is guilty of worrying sheep. Kids are not able to care for themselves. Grown goats will offer fight, and a sheep-killing dog never wants to encounter any other animal that fights; and yet a hungry dog may do considerable damage to a goat that offers fight. Whoever is familiar with the common goats that are so often found about livery stables has observed that dogs always give the goat the right of way; these goats have been trained to fight, and this has made them masters. A goat does not need much training to make him fight a dog, and this little should be given to a buck for the benefit of the whole flock.

IMPORTATIONS AND IMPORTING.

We shall never know how many goats have been landed upon our shores from foreign countries previous to the establishment of strict quarantine by the Department of Agriculture; but in the aggregate there must have been quite a number, since they came as mascots of sailing crews; and, too, immigrants were sometimes successful in landing with kids in baskets. However, there appears nowhere to have been an effort to keep the blood of any such animals pure, and any virtue that there might have been in any of the breeds imported was soon dissipated in the numerous and indiscriminate crosses that followed. It is not likely, however, that any such animals were of the leading milk breeds, such as those of Switzerland, Malta, or North Africa. They probably came, rather, from Italy, the West Indies, South America, or the British Isles.

The real record of importations of milch goats into the United States begins with the date of July 11, 1893, when W. A. Shafor, Hamilton, Ohio, who is secretary of the American Oxford Down Record Asso-

ciation, and also secretary of the American Milch Goat Record Association, imported 4 Toggenburgers which he purchased in England. Owing to many adversities, not of sufficient importance to recount here, these animals did not thrive, and at this time only a few head remain.

The second importation was made by William J. Cohill, Hancock, Md.; Robert N. Riddle, Carteret, N. J.; William More Decker, Buffalo, N. Y.; and S. King Bayley, Westwood, Mass. These animals were personally selected in Switzerland by F. S. Peer, all coming through the Canadian quarantine. They arrived in the United States May 25, 1904. This importation consisted of 16 Toggenburgers and 10 Saanen. They had a hard voyage and consequently arrived in very poor condition. Five have since died, but the death of 3 of these resulted from accident. The remainder of the importation is now reported to be in excellent condition.

It is necessary to record here another importation (date unknown) of two milch goats from the Black Forest of Germany (usually regarded as Swiss goats), now the property of William J. Cohill, of Hancock, Md. These animals he secured from Carl Hagenbeck, at the World's Fair, in October, 1904. The breed to which they belong is not definitely determined, but, as elsewhere stated, the writer is of the opinion that they are of the Schwarzwald breed. As both of the goats mentioned are does, and there are no others of the kind in the country, so far as known, the breed can not be perpetuated pure under present conditions. A picture of one of Cohill's goats of this breed is shown on plate 7, figure 3.

REGISTRATION.

The American Milch Goat Record Association was organized on November 12, 1903. It came into existence for the sole purpose of encouraging the establishment of a milch goat industry in the United States. Recognizing the difficulties to be encountered in importing purebred animals from Europe and Asia, the founders of this association decided to admit animals upon a very liberal basis. It was evident that the foundation stock of this new industry, with very few exceptions, must be selected animals from the nondescript varieties already in the United States. Therefore it was decided that the chief qualification for registration in this association should be that the doe shall yield at least 2 quarts of milk per day. The period of lactation to be required has not yet been determined upon.

This association registers all breeds which have the proper qualifications, and under this registration the animals are known as American milch goats, a proposed breed which is discussed on the next page following.

As there are now in the United States a few head of purebred Toggenburg and Saanen goats, every effort should be made to keep them pure; and, although they are registered as American goats, a separate register for each of these breeds has been started and all the importers have registered their stock in them.

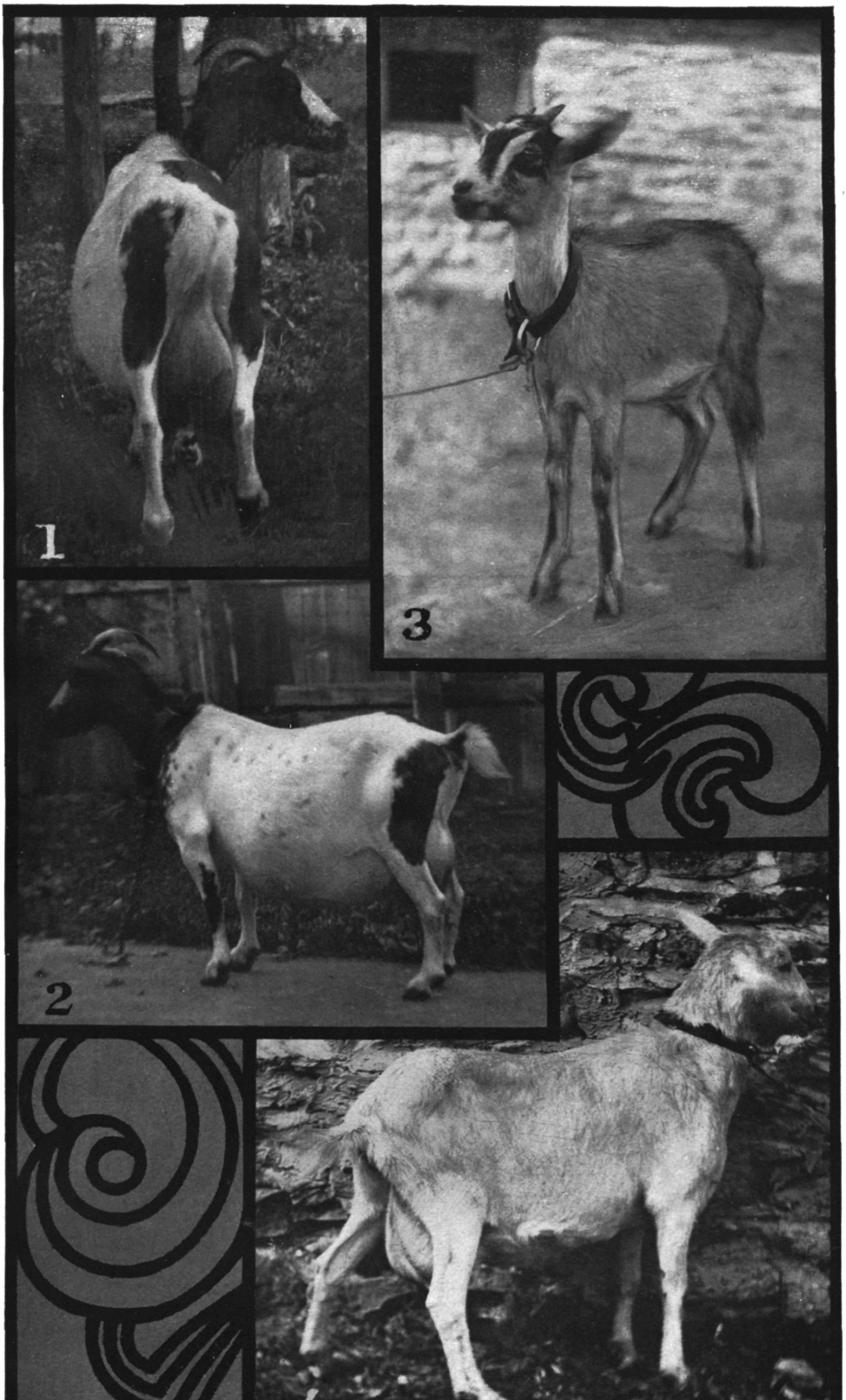
Further information regarding registration may be obtained from W. A. Shafor, secretary of the American Milch Goat Record Association, Hamilton, Ohio.

BREEDS OF MILCH GOATS.

The goat was probably one of the first animals to be made to subserve the interests of man, yet no other domestic animal has been bred so aimlessly and so carelessly as it has been. It is found in all parts of the world, and the varieties are so numerous that no effort has been made at any time to classify them into breeds. The purpose in this work is to mention but a few, and these of the milk-giving type. It must not be understood that this list mentions all of the kinds of milch goats, but those only which have been developed most highly for milk production. Only a few of the Swiss breeds are described, although Anderegg is authority for the statement that there are in Switzerland not less than sixteen pure breeds of goats. It appears that each valley there has its own distinct type of goat and the resident of no valley has any desire to import a variety from another valley, no matter how beneficial this might prove to be, and, indeed, his own valley people would resent such action.

The descriptions which follow are almost wholly from German writers on goats. The breeds that are represented in the United States are the Toggenburg, the Saanen, and the Schwarzwald. The other breeds are mentioned in order to give such information as is at hand for the benefit of those who may desire to know something about them.

The American goat.—This is a name which has been suggested for the breed which it is desirable to develop by selection from the so-called common goats now in this country. It is known that among these goats there are often found some excellent milkers, although their origin is obscure. We are told that some of the Italian immigrants have frequently brought with them from the old country very young kids in baskets. These were cared for as one of the children and among the children, and they have no doubt grown up and exerted a considerable influence upon the general average of the milk supply in the neighborhoods to which they were taken. Other good milkers are said to have been brought from Bermuda, and this blood has probably had its effect also. We should not be surprised, then, when we occasionally hear of a goat that will give from 1 to 2 quarts of milk



AMERICAN MILCH GOATS.

Photographs of figures 1 and 2 furnished by Mrs. Edward Roby; figures 3 and 4, by Dr. Wm. More Decker.

QUEENSLAND MILCH GOATS.

Photograph furnished by J. R. Chisholm, Queensland.

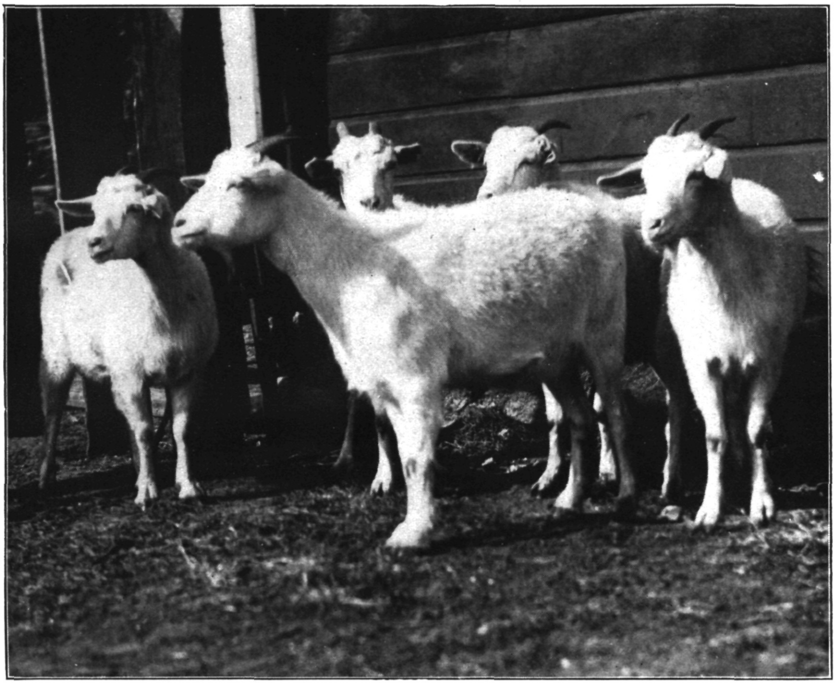


FIG. 1.—AMERICAN MILCH GOATS.
Photograph furnished by Wyatt Carr, Iowa.

FIG. 2.—AUSTRALIAN GOATS.
Photograph furnished by H. Hocking, Australia.

daily. Very recently this Bureau has been informed by a business man of New Jersey that there is a large number of goats kept in the Italian quarter at Palisades Park, and upon special inquiry he learns that the average amount of milk produced, so far as an estimate can show, is 3 pints per day. This milk retails among the Italians at 12 cents per quart; and butter is also made there from goat's milk to a limited extent which sells at retail in New York City at 30 cents per pound.

These are the kind of goats that should be selected as a foundation for the American breed, and if their milk characteristics were further increased by crossing with either the purebred Toggenburg or Saanen bucks which are now in this country, we should soon see a breed that would produce a satisfactory amount of milk and at the same time have all of the hardiness possessed by our common goats.

Some work along the lines suggested has already been done in various places, and occasionally a very good milker is produced. One of these animals showing excellence is Watita (pl. 28, figs. 1 and 2). When this doe was fresh and on green food, she "gave almost a gallon of milk per day," to quote her owner's words. The illustration, which is furnished by Mrs. Edward Roby, the owner, of Chicago, Ill., shows the doe at 3½ years old and 3 months after her second kidding. At the first kidding of the doe she dropped four kids and three the second time. Her conformation and record show her to be a very desirable animal as one of the mothers of the American milch goat.

Two similar animals are Bluebell and Mrs. Cotton (pl. 28, figs. 3 and 4), photographs of which are furnished by Dr. William More Decker, the owner, of Buffalo, N. Y. A glance at the picture of the latter shows her to be much above the ordinary goat, while the former shows some of the markings of the Toggenburg breed. Bluebell is 5 months old, bluish gray trimmed with black, and the hair noticeably soft. Her mother produced a good quantity of milk that was of very high quality.

The writer is indebted to J. R. Chisholm, of Queensland, Australia, for the photographs of the row of milch goats shown by plate 2. This gentleman states that there are in his country large numbers of such goats that will yield 3 quarts per day. They are not purebred animals, and, so far as is known, they have no blood of any of the pure breeds. The animals shown in the illustration indicate what is possible for American breeders.

The Maltese goat.—This well-known breed of goats is, as the name signifies, from the island of Malta, in the Mediterranean Sea. The island comprises but 95 square miles, and its population at this time is about 200,000. There are kept on the island, however, about 30,000 goats (among which are enumerated a few sheep) for milking

purposes, while the number of cows is only about 900. There are no pastures there. David G. Fairchild, agricultural explorer for this Department, notes that the goats are fed on scraps of all kinds, such as they may be permitted to pick up on the streets, where they usually wander about in small droves. This habit of subsistence is certain to give to the milk an unpleasant flavor, and it is not a matter of surprise that the English contingent of the population prefer condensed milk from England or the United States. "Their milk has the usual strong taste," says Fairchild, "but is drunk either alone or with the morning coffee by many Europeans regularly, and one soon becomes accustomed to it."

The proper winter food for the Maltese goats is the chick pea, broad bean, and sulla, all of which are grown all over the rocky island. In summer they obtain much feed from the leaves of maize and prickly pear.

The hair of this breed is long, the color being white and reddish brown or black. Hook says, referring to those which have been imported into England, that "the color is almost invariably white, with more or less red markings."

The Maltese goat is usually hornless, but the presence of horns is not an uncommon sight. The legs are short and the body compactly built. The ears are moderately long and are horizontal. The udders are large, oftentimes nearly touching the ground as the animal walks.

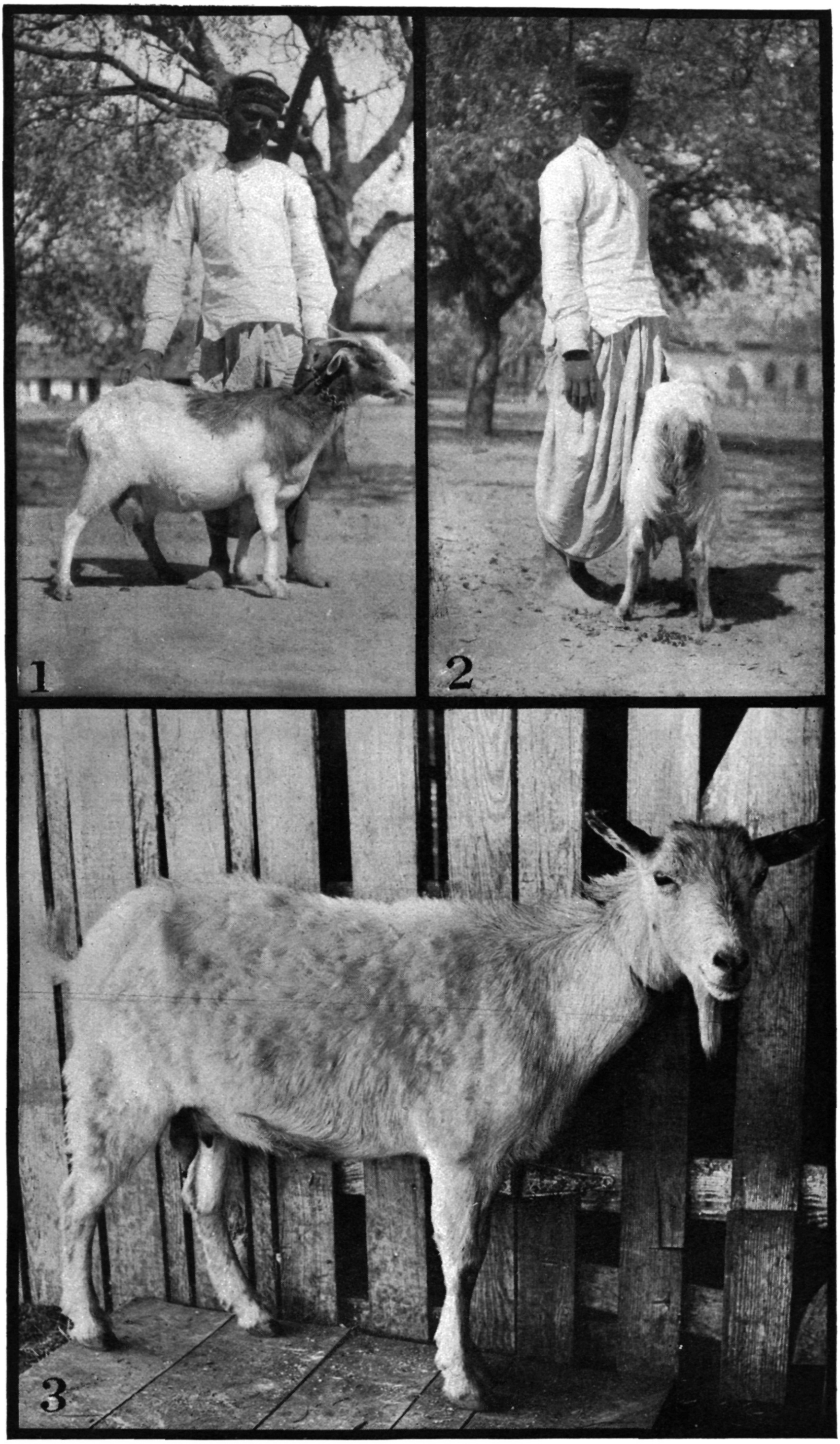
Hook says that it is quite difficult to acclimatize them in England. The weather appears to be too cold and wet. The real injury is probably due to the wet cold rather than to the cold alone, for they have hair enough to protect them against ordinary cold. We know that no dry cold is too severe for the Angora, but a little wet cold often causes death, and probably the Maltese is influenced in the same manner.

The same difficulty of acclimatizing would no doubt be encountered in some parts of the United States, but Fairchild, who is familiar with the climate of Malta, says:

> It is my opinion that, with proper attention to the matter of feeding and a consideration for their social habits, this breed of goats might be introduced into southern California with great advantage. They could possibly be substituted for the wild breed which now overruns the rocky islands off the coast near Santa Barbara.

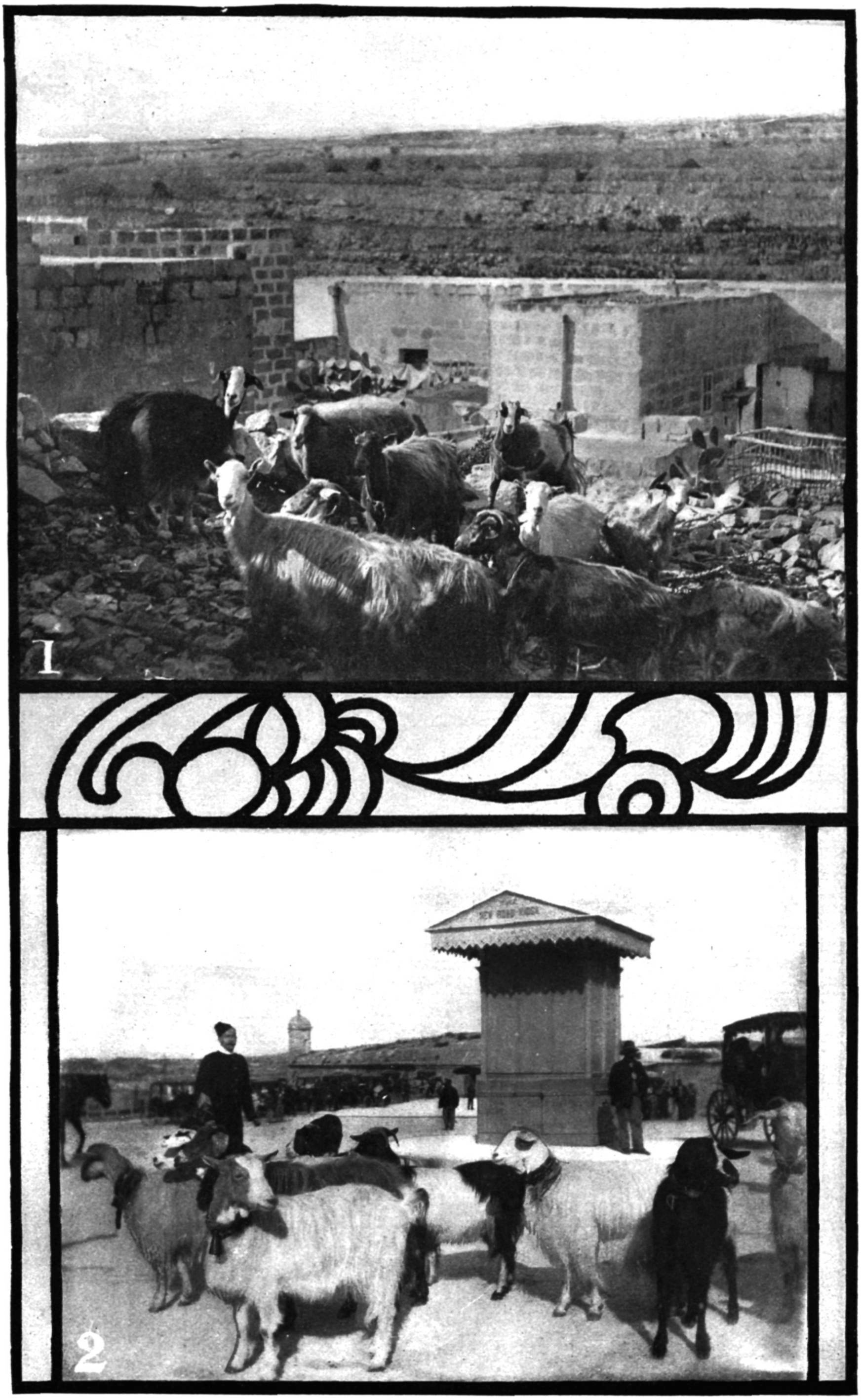
There is a prevalent idea on the island of Malta that the Maltese goat does not do well when transplanted to the mainland, but the idea is a mistaken one. This breed of goats when raised in Tunis, for instance (pl. 33, fig. 2), is in every way equal to those raised in Malta. Fairchild's observation was that the goats thrived as well and the udders were as fully developed in Tunis as in Malta.

Whether or not the Maltese goat will thrive in any part of the United States is a matter for the future to settle, for no animals of this breed



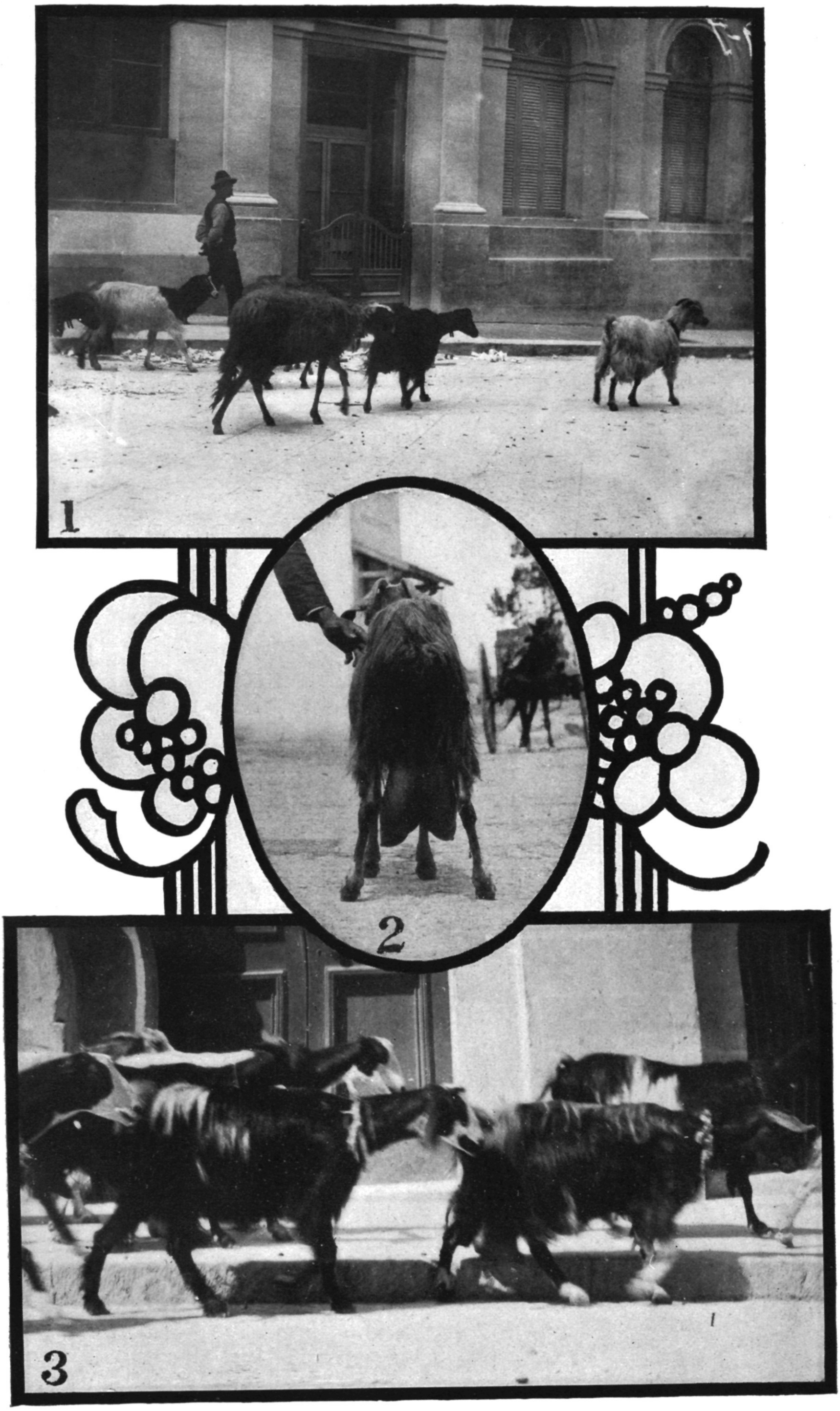
FIGS. 1, 2.—POONA (INDIA) GOATS. FIG. 3.—SPANISH-MALTESE GOAT.

Photograph of first two furnished by David G. Fairchild and of the last one by B. H. Van Raub, Texas.



Maltese Milch Goats.

Photographs by Sallie Russell Reeves.



MALTESE MILCH GOATS.

Photographs by Sallie Russell Reeves and David G. Fairchild.

have ever been imported. If a warm climate is necessary, our entire South and Southwest would undoubtedly prove adaptable. All long-haired goats now in this country thrive well in the cold sections, if they are not exposed to wet cold, and it is confidently believed that the Maltese, having long hair, could soon be acclimatized. The long-haired Mexican goat finds no difficulty in surviving the cold of our Northern States, and the Maltese may prove itself as hardy. A few years ago a few head of Maltese goats were imported into Canada, and it is reported that they are there fulfilling all expectations.

It should be stated in this connection that this breed is entirely different from the Spanish Maltese goat, which is discussed hereafter.

With reference to milk production, the Maltese goat is among the best breeds. They have been bred so long in Malta for the single purpose of milk production that most of the does are good milkers. This feature is more constant among them as a breed than among the Toggenburg or Saanen breeds. The period of lactation is a long one, and the quantity of milk given is from 3 to 4 quarts daily.

The milk vendors in this island drive their animals along the street from door to door, and draw the milk as it may be required by the purchaser. The man or boy having the goats in charge squats behind the animal and draws the milk into a cup.

The Toggenburg goat.[a]—This breed is called the aristocrat of the milch goat family. There are some breeds that are more hardy perhaps, some that are more prolific, some that will show occasional individuals of greater milk production, and several that present a more robust appearance, but the Toggenburg seems to combine in itself more of these characteristics in high degree than any other breed.

This breed is from the Toggenburg Valley, a district forming a considerable portion of the Canton St. Gallen, in the northeast section of Switzerland and about 70 to 100 miles from Berne. Here they have been bred for centuries.

The color of the animal is brown (not dark brown), with a white bar down each side of the face, which may easily be seen in the accompanying illustrations (pls. 34, 35, and 36). The legs, below the knees and hocks, are light gray or almost white. There seems to be a general understanding throughout the Toggenburg Valley as to the markings and general characteristics of these goats, except as to the length of the hair. There are long-haired and short-haired Toggenburgers, and some breeders select the one kind as being more hardy and some the other kind, disputing the greater hardiness of the long-haired ones. Peer says: "Where I found in one flock Toggenburgers having long,

[a]This description includes that by Mr. F. S. Peer, who visited the Toggenburg Valley early in the year 1904.

medium, and short coats, I was not able to get a positive answer that one was hardier than the other." All agree, however, that the coat, whether long or short, should be thick and fine.

Notwithstanding the lanky and lean appearance of these animals, the does are quite attractive. The bucks have a harsh and most serious expression, owing principally to the shape of the head and the large, coarse beard. They are not given to fighting, however, and are free to a large extent from the odor that is generally so objectionable in males among most other breeds of goats.

The udder of the Toggenburger when distended is carried high between the legs. The teats are usually very large and long.

The Toggenburg is generally called a hornless breed, but instances are not uncommon where horns are developed. Peer states that he did not see a specimen having horns in the Toggenburg Valley, owing no doubt to the custom prevailing there of weeding out those that develop horns. And he further says that "among the animals of this breed selected by me for importation to the United States, one gave birth to a female kid that developed a perfect set of horns, which by the time she was 3 months old were fully 5 inches long." It is remarkable that at this writing (December, 1904) only one other kid from this importation has been born, and it, too, like the one Peer mentions, has horns.

The breed is somewhat slender, and one of its principal characteristics is its great leanness. Except for its greater size, it much resembles the Appenzeller; indeed, Hook, referring to the peculiar coloring and deer-like shape of the Toggenburger, says the facts suggest the possibility of its being a cross between the Appenzeller and the chamois, which abounds in that section of Switzerland. Peer says the opinion is general among the Swiss peasantry that the Toggenburger is the result of such crossing; and, while he believes this is extremely doubtful, he mentions a kid having "as perfect a pair of horns as ever was seen on a chamois." It may well be doubted if any cross of the kind was ever produced. The ears are pricked usually, but sometimes held in a horizontal position, and are of moderate size, as is the case with all Swiss varieties.

In discussing this breed, Hook points out an important feature which is applicable to all breeds, namely, that the high position occupied by the Toggenburgers as milk producers has been attained by the careful selection of individuals for breeding, and from their offspring, preserving those only for breeding which have proved themselves to be good milkers. This practice can not fail to lead to definite results if the selections are made intelligently. The Toggenburgers are especially noted for their great milking qualities, and in this particular they probably excel all other breeds, unless the Nubian is excepted. In Switzerland there are a goodly number of the more intelligent breeders

of these goats who are breeding only the best milkers. These goats give from 4 to 5 quarts a day, as a rule, while the best produce from 5 to 6 quarts, and, in extraordinary cases, as much as 7 quarts per day. Their persistence in giving milk is a noteworthy characteristic. Some of those that were imported last May (1904), and which were in lactation for the first time, are still giving milk (December, 1904), and will probably continue to do so until they are "dried off" by their owners. And yet they were carried from place to place in Europe before being placed on shipboard at Antwerp, then a sea voyage covering much more than the usual time before reaching Canada, and finally three days by express (without being milked or fed apparently) to their destination.

This breed can probably be acclimatized in the United States without difficulty. They will fare better in the mountainous sections than in the lowlands, and whenever they are taken to the lowlands they should be kept strictly away from marshy places, else their hardiness will soon disappear. Hook's observations on the Toggenburger in England are contained in the following:

> The Toggenburg goat is, in my opinion, by far the most valuable and the best suited to our climate of all the pure breeds that have been introduced into this country, and, having now become fairly common and well established with us, is the breed I should unhesitatingly commend to the attention of goat keepers.

The Saanen goat.[a]—The Saanen breed (pl. 37) takes its name from the Saanen Valley of Switzerland, which is about 70 miles southwest of Berne, where they are quite numerous; but they also abound in the Upper Simmen Valley. The Saanen is the largest breed of Switzerland; it is quite tall and lean and lanky, like the Toggenburgers. Its color is pure white or creamy white. The hair is short, except a strip along the spinal column and down the flanks and on the lower part of the thighs.

The Saanen does are especially beautiful, with slim, long, graceful necks, and clean, breedy looking heads; the head of the buck is decidedly masculine, but does not have the serious expression of the Toggenburger. The breast is well developed; as a rule, the udder is very pretty and carried high. This is considered a hornless breed, but, as with the Toggenburgers, occasionally one is found with horns.

Germany imports many of this breed, especially of the males, in order to cross them them upon the German farm goat, and the resulting improvement has been very pronounced. In 1893 it is said that several thousand head were taken out of the Saanen Valley. Notwithstanding this fact, the German writers are very careful to warn prospective importers that the breeders of Saanen goats in Switzerland are never inclined to sell their best milkers and that there are likely to be

[a] This description includes that by Mr. F. S. Peer, who visited the Saanen Valley early in the year 1904.

a large number of very poor milkers, which they do sell to anyone who will buy. In other words, while the name of this breed means much for some individual animals, it also means that the name is not a guaranty of high merit. Peer says:

> As compared with the Toggenburg family, my observations lead me to say that, as a family, there are propably more large milkers among the Toggenburgers than among the Saanen, but that the best of the Saanen goats are superior to the best Toggenburgers. In other words, taking a given number of each breed as they come, I would expect the Toggenburgers to show the largest total yield, but among the best of each breed, I would expect the Saanen to win.

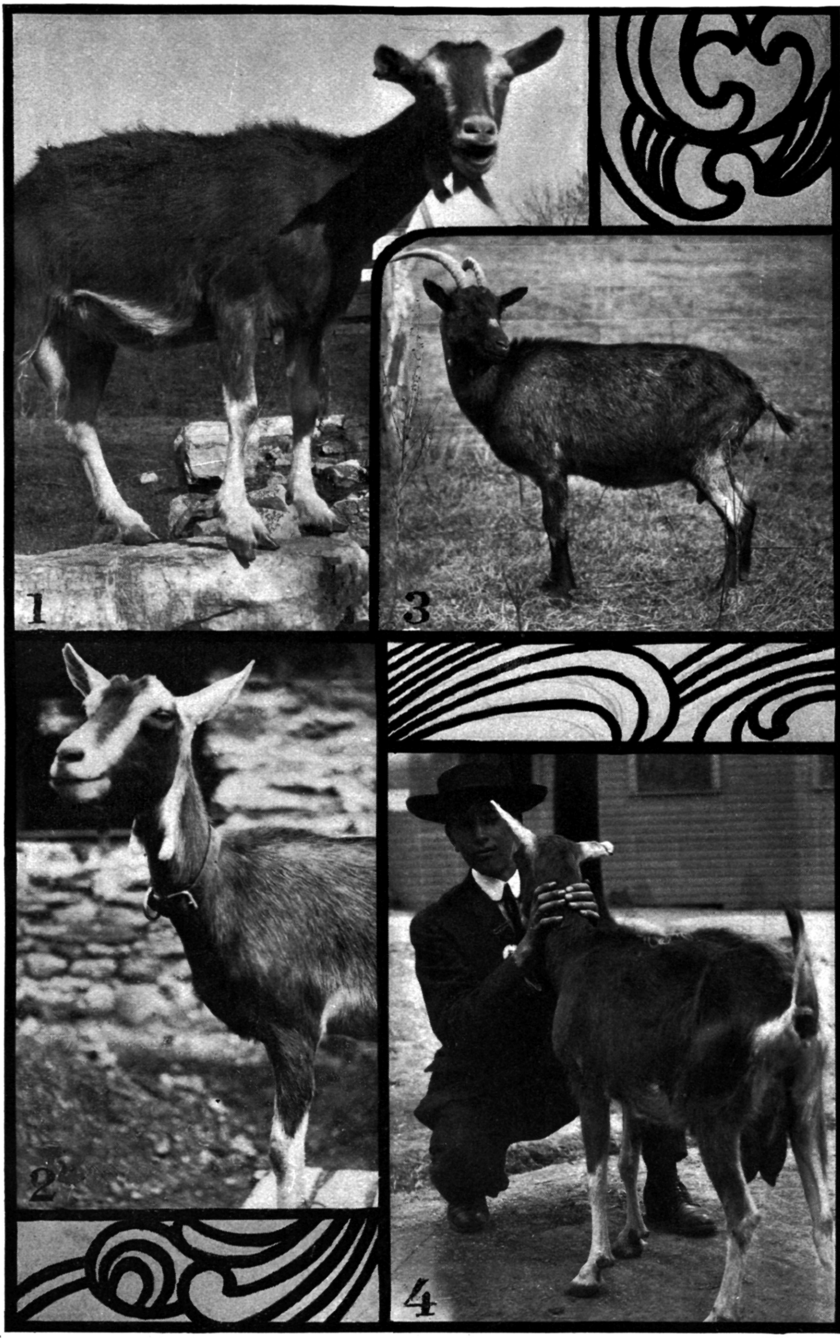
Doctor Kohlschmidt, director of the agricultural school at Freiberg, Saxony, conducted experiments in 1896 and 1897 with various goats to test their capacity for milk production, and one of his conclusions was that the Saanen goats, which had been imported into Saxony in 1894, with the same feed and methods of keeping that the Saxony goats had, could not be classed as anything better than the Saxony goats, as regards both quality and quantity of milk. Dettweiler speaks of Saxony as a place "where no one bothers himself about the goat," and therefore we have the right to infer that the Saanen goats which entered into Kohlschmidt's test had not been selected for importation with that care which is pointed out by most German writers to be so necessary. However, if the Saxony importations of 1894 were selected without much care, they proved to be fair milkers, as we shall see by the records below, and the Saxony goats that equaled their yield were excellent for common stock. In Kohlschmidt's experiment ten Saanen goats were employed—seven of them 3 to 3½ years old, and three from 2 to 2½ years old. The average quantity of milk produced during the year by these ten goats was 678.41 liters, and the smallest production was 421.94 liters. The following statement shows the annual production per head:

2 gave over	400 liters (423 quarts).
3 gave over	500 liters (528 quarts).
1 gave over	600 liters (634 quarts).
2 gave over	800 liters (845 quarts).
2 gave over	900 liters (951 quarts).

Animals of this breed which were fourteen months old gave an average during their first lactation of 509.72 liters per head per year. The maximum was 665.69 liters and the minimum 351.31 liters.

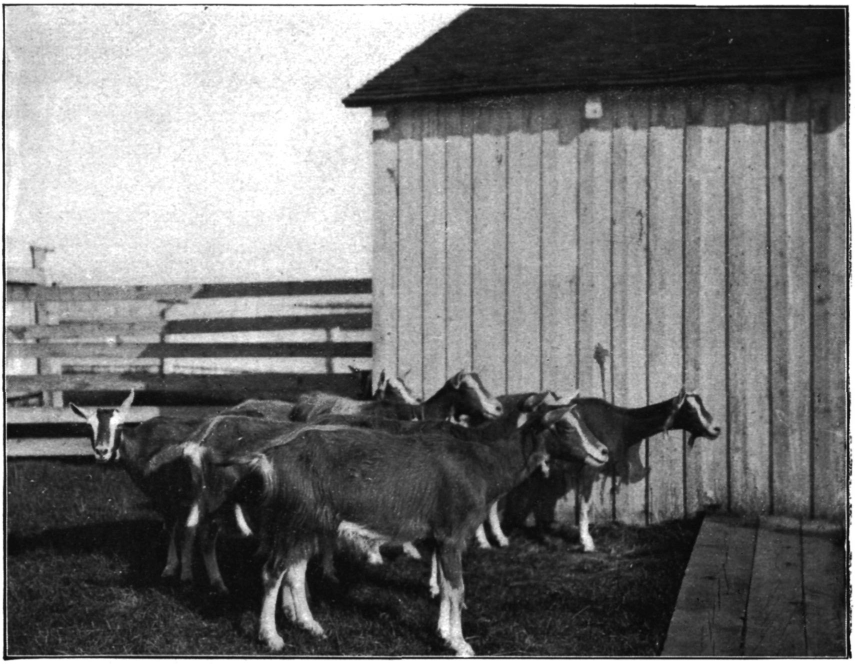
Wilsdorf says that Saanen goats, for a time after kidding, give from 4 to 6 liters of milk per day, and that "this yield happens not occasionally, but, as a rule, in the Saanenthal;" and Peer says "the best of them are probably the best in the world, giving from 5 to 6 quarts per day of the very best quality."

Neither Pegler nor Hook mentions any specimens of the Saanen breed in Great Britain, and it is not likely that there are any there.



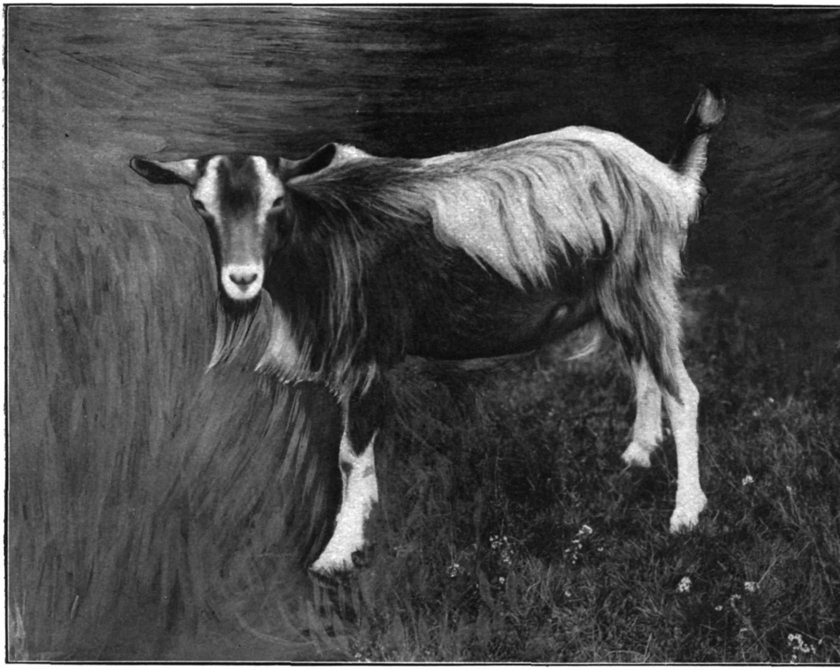
FIGS. 1, 2, 4.—IMPORTED TOGGENBURG GOATS. FIG. 3.—SCHWARZWALD GOAT.

Photographs of figures 1, 3, and 4 furnished by Wm. J. Cohill; figure 2, by Dr. Wm. More Decker.



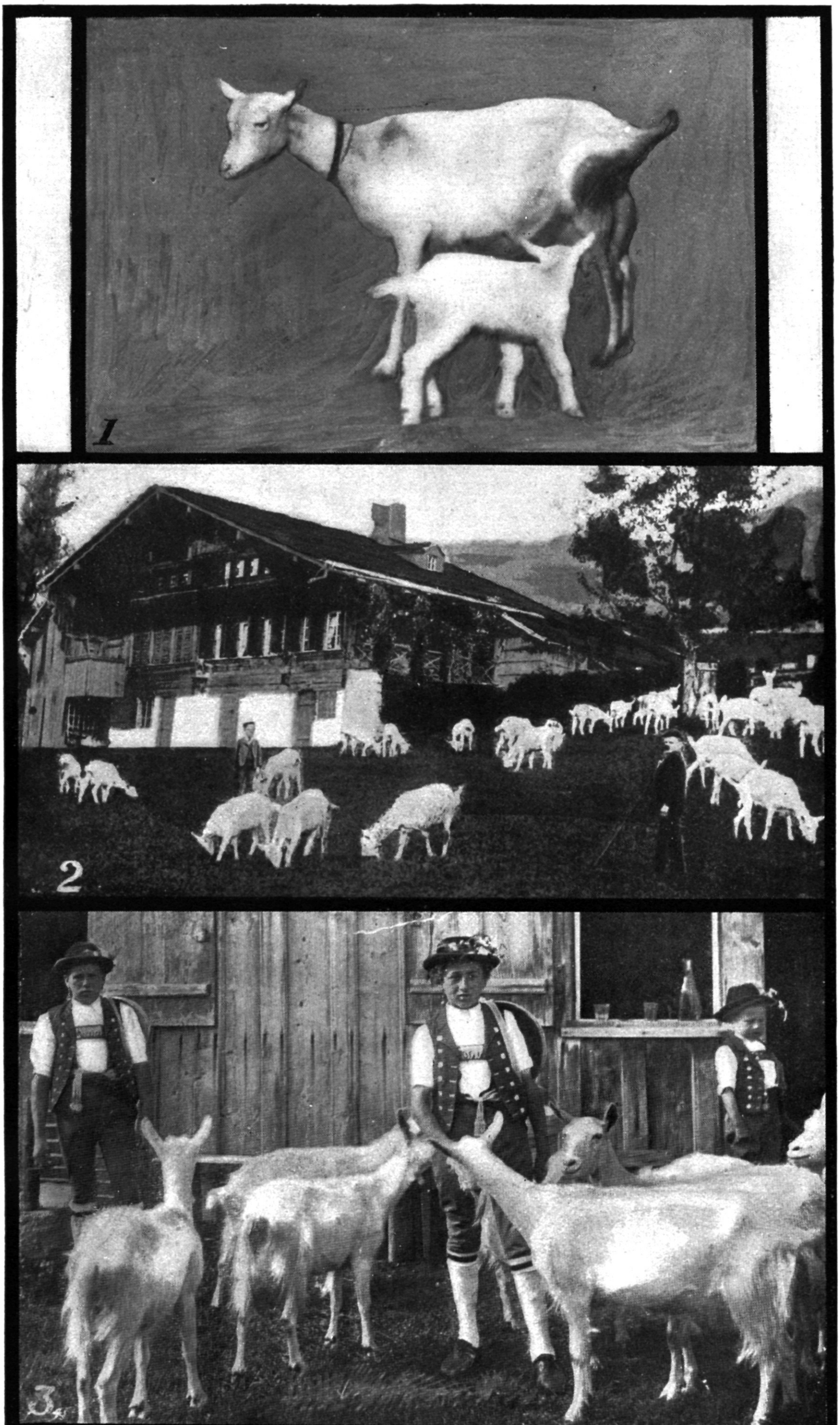
TOGGENBURG GOATS IN SWITZERLAND.

Photographs by F. S. Peer.



IMPORTED TOGGENBURG GOATS.

Photographs furnished by S. King Bayley, Massachusetts.



SAANEN GOATS IN SWITZERLAND.

Photographs by F. S. Peer.

Several head came to the United States in the Peer importation in May, 1904, and so far they seem to be acclimatizing very well. With rational treatment they will probably do well in any part of the country, but especially in the mountainous sections.

The Appenzell goat.—This is another Swiss breed. It shares with the Toggenburger the right of possession of the Toggenburg Valley, where both breeds are raised side by side. As the Government grants a subsidy to these breeds when kept pure, but never does so when crossed, they are seldom allowed to interbreed. The Appenzeller is a good milker, and is considered inferior only to the Toggenburger and Saanen. It is often mistaken for the latter, especially in the case of those that are pure white. Some of them are, rarely, dark or spotted.

The Appenzeller weighs about 110 pounds. Its head is flat and hornless. One of the strong claims made for it is its great hardiness. It is easily acclimatized. In Switzerland many are kept in stables.

Anderegg is authority for the statement that the Appenzeller produces 3½ liters of milk per day.

It is said that the results of crossing this breed with either the Toggenburg or Saanen breeds are always negative.

The Schwarzthal goat.[a]—This breed, sometimes called the Glacier goat, or the saddle goat, belongs to Canton Valais, of Switzerland, and is specially numerous in the Rhône Valley. The frontispiece of Hook's "Milch Goats and Their Management" is a picture of several of these goats in the Rhone Valley. It is a large animal, having legs and horns resembling the chamois and a tuft of long hair on the forehead. It is a very striking animal because of its size and its coloring. The first third of its body, including the head, the neck, and the breast, is black, while the remainder of the body is pure white; these colors meet just back of the shoulders. The front hoofs are black and the hind ones white or yellow.

This is one of the hardiest of the breeds, if not the hardiest, as it withstands exposure better than any other of the goats of Switzerland or France. Because of this hardiness principally, but somewhat on account of its peculiarly striking colors, it is selected for export to Holland, Germany, Norway, and Sweden.

Another peculiarity of this goat, according to Pegler, is that "it almost invariably has but one kid at a birth," though it yields a large quantity of milk.

The quantity of milk given by this breed is not equal to that yielded by the other principal breeds of Switzerland, and the quality is also inferior. The following is from Hook:

> Very large herds are to be seen on the Eggishorn and Reider Alps. At the latter place I once chanced upon a herd just as the herdsmen commenced the evening

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[a] This description includes the observations of Mr. Peer.

milking. There were two milkers, and as each goat was finished a young assistant caught and presented another, and the whole herd of fifty or sixty animals was milked in a remarkably short time, the produce being carried in one of the upright tubs upon the herdman's back; but I must say that I considered the amount on this occasion very small for so large a number of animals. These goats, however, were not so carefully treated, and not housed as are those of the Toggenburg Valley, and after having been milked were driven off to spend the night upon the mountain side.

At the time of Hook's writing (1896) the only specimens of this breed in England were in the possession of one man. There is very little in print about them, but that little seems to indicate that their hardiness is their only feature that would recommend them for the United States.

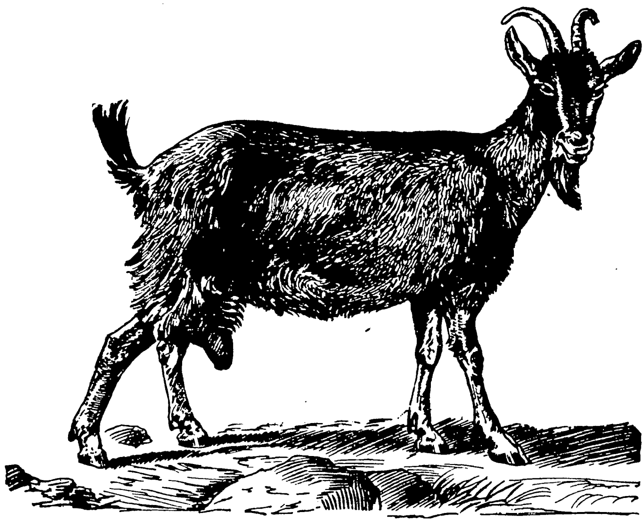


FIG. 47.—Schwarzwald Goat. (Copied from Hoffmann.)

The Schwarzwald goat.—This breed (fig. 47) is generally fawn colored, with a black stripe down the middle of the back, some dappled, and occasionally some white animals. The skin is soft and smooth, with short shining hair. The head is graceful. About one-fourth of the goats are horned. The eyes are gray, the ears thin, long, and placed well up. The neck is thin and slender and well set, with abundant hair about the throat. The withers are low, the chest quite broad, the shoulders rather strong and rounded, the back even, and running on an even line to the hips. The belly is very thin, and does not hang down. The hips are long and somewhat sloping. The hind legs are often somewhat bandy; the position of the forelegs is normal. The udder is, in the greater number of cases, large, pliant, and thinly covered with hair, and is placed well back between the hind legs; the teats are somewhat large.

The animals are bred in the region of Neckar and Donau, southwestern Germany. The occupation of goat breeding is divided among the laborers, factory hands, poor people, and also the middle class; the people possess, on an average, two animals apiece, the highest number being seven. Stables, with pasture, are rented out from September till November. The city of Tuttelingen, for two years past, has conceded a permanent pasture to the goat owners.

On plate 34 (fig. 3) is shown a picture of one of two goats which William J. Cohill obtained from Carl Hagenback, at St. Louis, and this writer is of the opinion that these goats are of the Schwarzwald breed. The description, which is from a German author, and a comparison of the illustrations, with the further aid of a personal inspection of the specimens in Mr. Cohill's possession, lead easily to this conclusion.

The Langensalzaer goat.—The district in Germany where this goat is bred is the Northern Thuringia, the upper section of Unstrut, between Heinich and Hainleite, including the district of Langensalza, the western part of the district of Weissensee, the southern part of Muhlhausen, and the northern part of the Duchy Gotha. The altitude of this section is from 450 to 1,000 feet. Löbe says this breed is especially suitable for level tracts of land.

This breed (pl. 38, figs. 1 and 2) is of various colors—brown, black, and white, or a mixture of these. In the Langensalzaer district the prevailing color is white. This goat is hornless, according to Dettweiler. There appears to be no uniform type, but three classes may be distinguished: (1) The common goat, almost identical with the common goat of Thuringia, and having no purity of blood; (2) a goat improved by breeding and selection, found in the neighborhood of Langensalza; (3) a goat improved by crossing with Saanen bucks.

The third class is preferred, and it predominates; and it is the one usually in mind when the Langensalzaer goat is referred to. In its improvement it has much of the appearance of the Saanen breed.

Petersen's description of the Langensalzaer goat is in the main as follows: It differs from the Saanen goat in its more refined frame, shorter limbs, and long barrel. The coat of hair is generally short and smooth, rarely long; the forehead almost square; eyes large and intelligent; ears erect and pointing forward; neck long and slender but somewhat heavier at base than elsewhere; withers well rounded; back straight; hips dropping; chest narrow, but deep and extending far back; belly round, but not hanging, and showing deep "hunger hollows;" loin not very deep; hind legs inclined to be cow-hocked (occasionally there are cases of stiff legs). The bones are fine, and the pastern short. The udder is broad and deep, similar to that of the cow, almost globular, and not in two lobes, as in other Swiss breeds; teats

long and hanging forward of the legs, nearly reaching to the ground in old goats. Oftentimes two rudimentary teats are present and yield milk.

This goat is a good milker. The annual milk yield is often large—in individual cases having been known to reach 1,800 liters. (Dettweiler.)

The Starkenburg goat.—This breed is referred to in the German literature as a noble animal. It is the result of a large infusion of Saanen blood, and is oftentimes mistakenly called the Saanen. It is raised in Pfungstaat, Heppenheim, and vicinity.

The Guggisberger goat.—This breed, sometimes called the Schwartzenburg-Guggisberger (pl. 39, fig. 2), was originally from the Simmen Valley of Switzerland. It is brown, spotted like the chamois, commonly has horns, and is considered very excellent for milk. Of recent years it has been extensively crossed with the Saanen goats. Hilpert describes it as being built like the Saanen goat, of fawn color, or brownish white, and of astonishing size. He says it is excelled by no other breed of goats in milk production when under good care and feed. The Guggisberger is well proportioned, and the accompanying illustration shows that this breed has the points of a good milker. It is also said to be a near relative of the Oberhaslian goat.

The Gassenay goat.—The Gassenay goat is of Canton Berne, Switzerland. It is pure white, like the Saanen and Appenzeller. Anderegg, a Swiss authority on the goats of that country, speaks in very high terms of this breed. Hook says that a few specimens have been imported into England, but unfortunately have not been kept pure. Gassenay appears to be another name for the city of Saanen, and it is not unlikely that the goats bearing these names are the same breed.

The Harz Mountain goat.—This breed is the product of the Harz Valley and others connecting with it, all of which are from 1,000 to 2,000 feet above sea level. Here the soil is calcareous and the water comes pure from springs. The climate is rather rigid. The animal is astonishingly large and has a strong bodily development.

The color varies from whitish gray to reddish, with a dark streak along the back; sometimes it is black or brown, or a mixture of these colors. The hide is quite thick, a condition due to the severe climate. The hair is of medium length, seldom short and smooth; the head short and broad; eyes gray; ears long and narrow, yet many have lop ears or so-called mouse ears; horns absent in most cases; neck medium long, withers strong, back straight, loins and chest broad, belly deep, thighs rather full; the legs are generally straight, but in exceptional cases cow-hocked.

The udder is well developed, bilobed as a rule, with large teats hanging between or a little back of the hind legs. When fresh the milk production is from 2 to 4 liters a day, increasing in good animals to 5 liters, and the amount for the entire period of lactation, which is about three hundred and twenty days, is from 500 to 700 liters. The taste of the milk from this breed is especially good, and everywhere throughout the Harz Mountains the milk is used as an article of diet, especially for the poor and for the invalids who sojourn in that district in large numbers.

The Wiesenthal goat.—The Wiesenthaler is a hornless mountain goat with a middling long head and sparkling eyes. The hair is short and light in color. The udder is globular in form, with a good devel-

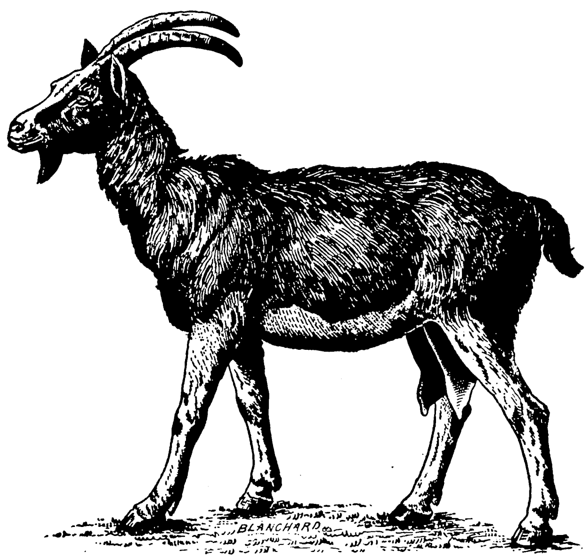


FIG. 48.—German Farm (or House) Goat. (Copied from Zürn.)

opment of teats. When the doe is fresh her yield of milk is from 2 to 5½ liters per day, the average being about 3 liters. The quantity for the whole period of lactation varies from 600 to 900 liters. Petersen (from whom these notes are made) mentions one case where 982 liters were produced from a doe that had a lactation period of three hundred and fifty days. The quality of the milk is excellent, having especially a high percentage of fat.

The Saxony goat.—This goat can hardly be regarded as a distinct breed. It has been developed by selection from the common, or farm, goats, and by the introduction of Swiss blood, principally of the Saanen breed. Doctor Kohlschmidt, an agricultural teacher at Freiberg, has

said that the Saxony goat is equal in milk productiveness to the Saanen. His opinion was based upon personal experiment; but it is said by others that the Saanen goats employed in this experiment were imported and in all probability they were very poor specimens, for nearly all German writers refer to the practice of the Swiss in selling their poorest animals, if possible, rather than their good ones and lament the fact that the German importations are of the poor kind.

However, experiments with Saxony goats which were conducted in 1895–96 in the locality of Lauenstein, Altenburg, and Geising, with 30 goats, gave the following results, which indicate that the Saxony goat is an excellent milk producer. The annual milk yield of 27 goats of various ages, based on five experiments, was found to average 725.7 liters per head. Of the 24 mature goats, 9 gave 600 to 700 liters per head, 7 gave from 700 to 800 liters, 4 gave from 800 to 900 liters, 1 gave over 900 liters, and 3 gave 1,000 liters. The highest milk yield was 1,077.5 liters and the smallest 612.3 liters per annum. The average lactation period was three hundred and thirty-two days, and the percentage of butter fat in the milk for the entire period of lactation showed a minimum of 2.74 and a maximum of 4.41, with an average of 3.43. These results show that the Saxony goat is a good milker and altogether a very desirable animal.

The Westphalian goat.—Frequent references are made in foreign literature to this breed, but Dettweiler is the only writer who gives any real information about it, and he gives but little. The quantity of milk which it gives varies. At Warstein the production is said to be but 2 liters per day for "fresh" goats, with a total annual yield (or for the whole period of lactation) of 200 liters. Other schedules are in existence, however, which show the annual yield to be from 365 to 500 liters. Dettweiler quotes the following from Mr. Petrasch, a magistrate of Hallenburg:

Average quantity of milk for fresh milkers, 3 liters daily.
Maximum quantity of milk for fresh milkers, 5 liters daily.
Minimum quantity of milk for fresh milkers, 2 liters daily.
For the entire period, 500 liters.
Duration of lactation, 330 days.

The Hinterwald goat.—The district of the Hinterwälder (or Forest goat) embraces the whole upper plateau of the Black Forest. The description of this breed is after Huber, a veterinarian of St. Blasieu. The color is white and brown, giving a gray mixture; the skin is thin, soft, elastic, and covered with short to medium-length hair; there is an absence of horns according to Huber, but Dettweiler, from whom the illustration (pl. 39, fig. 1) is copied, shows an animal with horns; fairly long face and broad forehead; jaw well developed; mouth large and broad; eyes large and clear; ears erect; neck strong with a cir-

cumference equal to its length; chest well developed, being broad, deep, and long; back generally straight; loins generally well developed; hips, dropping; legs sometimes cow-hocked. The udder in full-grown animals is well developed, firm, elastic, both halves being of uniform size, and hangs low in old animals only.

The milk yield is about 3 liters per day; it amounts to 4 liters in exceptional cases. The annual yield varies from 600 to 650 liters, testing 3.75 per cent fat.

The Hungarian goat.—There is very little information at hand regarding the Hungarian goats. Neither Pegler nor Hook mentions them, yet the following description of a single specimen was published in the proceedings of the Royal Agricultural Society, England (vol. 15, p. 664, 1879), in the words of the judges of the show at Kilburn:

> The prize winner, of Hungarian breed, exhibited by Lady Burdett Coutts, was certainly the largest he-goat that has ever appeared at any show. He was devoid of horns and had a fine head, with broad chest, level back, and well-sprung ribs, without being too long in the leg. He measured 34 inches in height at the shoulder and 46 in girth.

The Alpine goat.—Descriptive writers who have visited Switzerland have seldom failed to mention incidentally "the Alpine goat," yet very little is in print about it as an animal of economic value. Peer made no little effort to learn something about this goat, and the description here given is practically in his words.

The Alpine goat may be termed the native goat of Switzerland, corresponding in name to our "common" goats and the German "farm" goats, but not corresponding in important characteristics. These goats are found throughout the whole Alpine chain. There is but little uniformity among them, and therefore they can hardly be classed as a distinctive breed. They resemble grade animals of nearly every description. In one section certain markings may prevail and in another they are quite different. They have horns generally and are a hardy, serviceable animal.

The want of attention to certain uniform characteristics disqualifies them for breeding purposes among those who wish to follow a certain standard or type of breeding. In some districts in the Swiss Alps and also the French Alps some attempt has been made to breed to a certain form and color, but as a rule they are better classified as "all sorts." In France and Switzerland there are a few distinct families like the Saanen and Toggenburg; all the rest, except foreign goats of a distinct breed, seem to be lumped off as "Alpine goats." In some parts, however, local names are given to these goats. Some of these animals are exceedingly beautiful.

The Tarentaise goats from the French Alps, which are usually seen at the French agricultural exhibition at Paris in the beginning of

March, are very striking. They will be found described below under the heading "The Tarentaise goat."

There is another Alpine goat that is believed to have some local name. It is of a solid mulberry or mahogany red. These goats have a very short, shiny coat of hair, which sets off their graceful forms to perfection. They have very beautiful, clean heads, and altogether are, as described by Peer, the most breedy looking goats he has ever seen.

If these animals could be relied upon to breed true they would certainly be most valuable animals in the hands of any breeder who admires quality and beauty. There were quite a number of these so-called Swiss and French Alpine goats on exhibition at Paris last year, together with several other Swiss and foreign breeds, such as the Toggenburgers, Saanen, Nubians, Maltese, etc., which were said to be mostly from the zoological gardens of Paris. They created as much if not more interest than any of the other animals of the great exhibition.

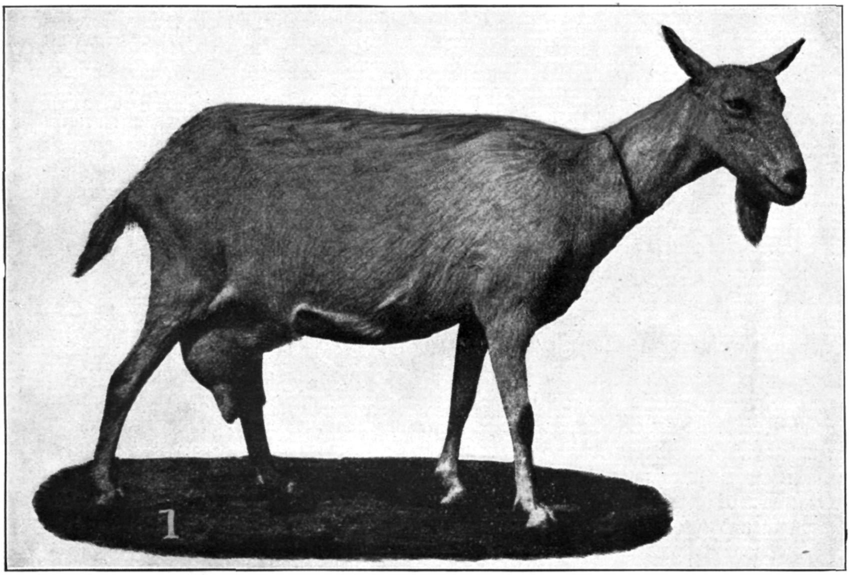
All of the Alpine goats, whether of the Swiss or French Alps, are good and useful animals. They are of early maturity, hardy, and give a good quantity of milk. Peer says they give from 4 to 5 quarts a day and that the best ones are said to give as much as 6 quarts a day.

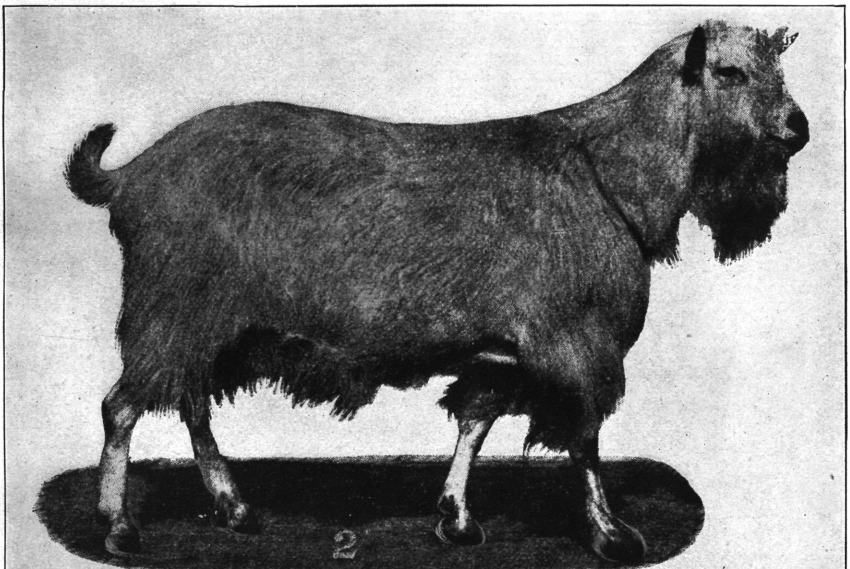
There are over half a million goats in little Switzerland, a territory less than one-third the size of the State of New York. There are among this great number only about 3,000 or 4,000 pure Toggenburgers and 2,000 to 3,000 Saanen; probably 10,000 would cover all the distinct breeds; the balance (490,000) are natives, grades, and what are generally called Alpine goats.

The Tarentaise goat.—The Tarentaise goat is not considered a distinct breed, but is one of the several varieties of Alpine goats; and under the head "The Alpine goat," Peer describes it as a very striking animal. Its head and neck are saffron red and the body shiny black, with a black bar down each side of the face. It has sufficient merit to warrant its exhibition at the agricultural show at Paris, and is said to be a good milker.

The home of this variety is the Department of Savoie, in the French Alps.

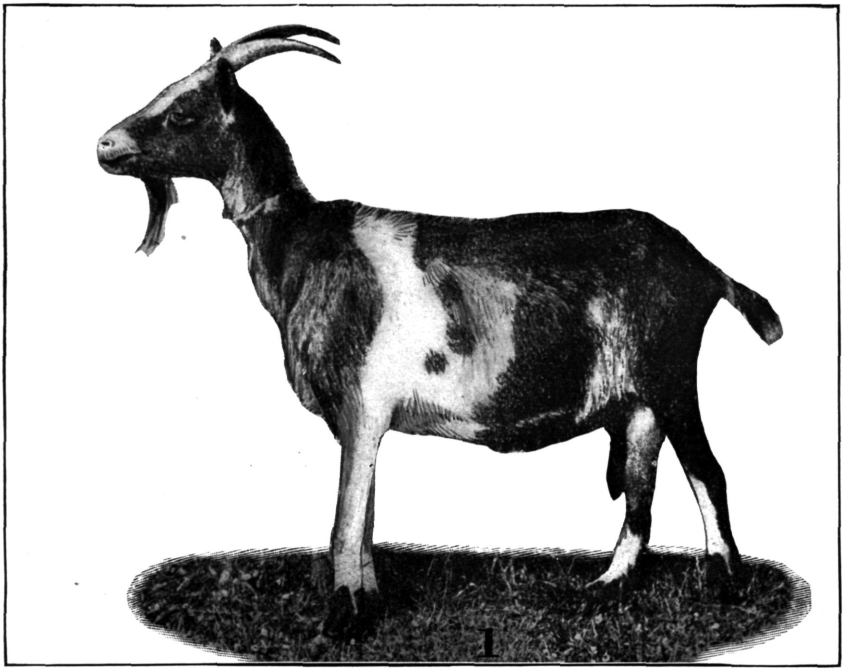
The Pyrenean goat.—This goat, as its name signifies, is native of the Pyrenees Mountains. It has long hair, long, pendulous ears, and large horns. It is the tallest of all domestic breeds, except possibly the Nubian. Several head have been introduced at different times into England and the crosses obtained from them have proved to be good animals. Pegler mentions some that were at the dairy show of 1884 "far exceeding in proportions anything yet produced in the way of goat breeding." This goat is a very good milker. Reports are





Langensalzaer Goats.

Photographs copied from Dettweiler.



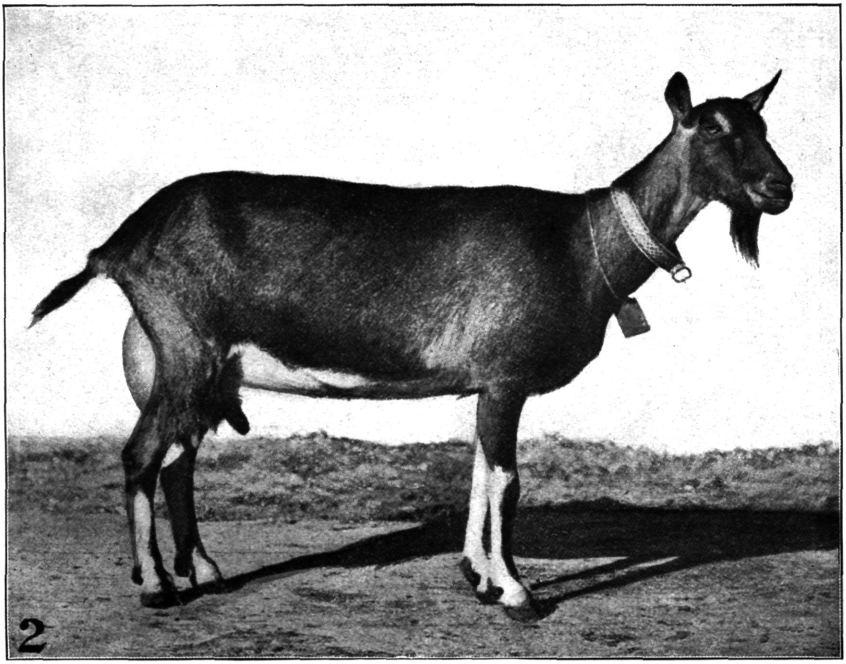


FIG. 1.—HINTERWÄLDER DOE. FIG. 2.—SCHWARZENBURG-GUGGISBERGER DOE.

Illustrations copied from Dettweiler and Hilpert.

published of large herds of this breed in the Pyrenees Mountains, where they are kept for the twofold purpose of cheese making and the production of skins for fine gloves. So far as known there are none of them in the United States, but they would probably thrive well in any of our mountainous sections.

The Spanish goats.—The term Spanish goat does not here mean a particular breed, for there are several varieties in Spain. Löbe refers to a "hornless Spanish goat," which is especially distinguished by its long silky hair. The illustrations which are shown on plate 40 are evidently quite a different variety from the one described by Löbe. These pictures are of the goats of Malaga and Granada, and were taken by David G. Fairchild, agricultural explorer of this Department. No records are available of the quantity of milk that the goats of Spain will give, but the size of the udder of those shown here indicates that it is considerable. It is said that all varieties of the Spanish goats are good milkers.

The English goat.—The English breeders began many years ago to produce from their nondescript stock a distinctive English goat. The lines of breeding which they pursued were the same as those proposed for the production of the American milch goat. The English have succeeded to a large degree, presaging the fact that the United States, with its more favorable climatic and soil conditions, ought to do much better in a shorter period of time.

England's climate is not suited to any of the imported breeds of goats, and her native goats were far from being satisfactory as milk producers. In order that there might be a goat that would withstand the damp climate and lowlands and at the same time produce a satisfactory quantity of milk, the English proceeded to import bucks of the Swiss and Nubian breeds for crossing upon the native does. By this method they have retained the hardiness of the native goat to a remarkable degree and at the same time acquired much of the milk-producing qualities of the Swiss and Nubians.

The following description of the English goat is from Pegler:

> I have been at some pains to ascertain the points of the original breed; and from the descriptions in old works in which goats are mentioned, and a comparison with the features most prevalent at the present time, I believe the following description to be correct: Head neat and tapering, with moderate beard; frontal bone prominent, horns set far apart, rising slightly at first with an inclination to the rear, and then branching outward; ears rather large, but not actually erect nor yet pendulous, but more approaching a horizontal position, pointing forward. Body long and square shaped, with the coat short, but not so close as in the Nubian and some Indian varieties. In the male it is much longer, particularly at the neck, chest, and thighs, where it is very thick and stiff. A fine, soft, wooly undergrowth is nearly always observable between the hair. The color ranges from black to white, but is more often light or dark fawn, with a darker line along the back and black on the legs.

In a personal letter to this writer, Hook believes it would be wise for the people of the United States to secure some English goats to breed up the common stock here. It can hardly be doubted that the result of such a procedure would be very beneficial, for the English goat is really a good animal.

The Irish goat.—This goat is mentioned and described in order to forestall any desire to import the blood for American use. The following is from Pegler:

The hair is long and shaggy, generally a reddish black and white, or yellowish gray and white. The head, instead of being short and tapering, is long and ugly, the muzzle being coarse and heavy, with a considerable amount of beard even in the females. The horns are large and pointed, situated close to each other, and rising almost perpendicularly while inclining to the rear. Those of the male are very large, and attain sometimes an immense length, a pair in my possession measuring each 30 inches. Besides the increase in size, they open out more than those of the female. The size and shape of the horns render both male and female formidable antagonists when pugnaciously inclined, which they not unfrequently are, both to each other and to persons who are strangers to them, so that they are not altogether safe with children. The Irish goat is a rather taller animal than the English, but its gaunt, flat-sided appearance renders it anything but prepossessing. It is nevertheless a good milker, though the yield is comparatively poor in quality. The udder is generally long and narrow, with big teats.

Pegler does not say much for the Irish goat, but Hook, in the following, says less:

Of small size, with long shaggy coat and large horns, it has little but its low price to recommend it. Rare examples may be found to yield a large quantity of milk, but only for a few months after kidding; and, as it is impossible to induce these animals to breed, except as their half-wild nature prompts, the production of milk in winter is entirely out of their power.

The Welsh goat.—It is believed that in a former time there was a distinctive breed of goats in Wales and also in Ireland, but the Irish blood appears to have dominated and overrun both countries. It is believed that originally the Welsh goat was large, white in most cases, and of a kindly disposition; but this is not the case at this time. Pegler says of it:

In many points it resembles the Irish goat, but is smaller and more symmetrically shaped, the head and horns being more graceful and the body lighter. This breed is not of much value for milk. The udder and teats are usually small, and it does not remain any length of time in profit.

The Nubian, or Abyssinian, goat.—This breed (fig. 49) is the most peculiar of all goats, and in many respects differs so much from other goats that at a distance it may be mistaken for some other animal—at least not be taken for a goat.

It is a native of Nubia, Upper Egypt, and Abyssinia. With slight modifications, it may be found in other parts of the African continent as far south as the Cape of Good Hope.

Its size is extraordinary, being fully a half larger than ordinary goats, and it has very long legs. In a pronounced degree this goat

has the rounded forehead and nose that are so characteristic of all African sheep, but why this similarity exists no one ventures to say. Below the top of its head the forehead rises so as to form a conical prominence, then sinks toward the nose until the nostrils are in an actual depression. The lower jaw protrudes beyond the upper, and the teeth often extend above the nostrils. The ears may be flat, long, large, and pendant, or very short, straight, and pointed.

The Nubian is considered a hornless breed, and it is probably as nearly hornless as any breed, yet it frequently occurs that the bucks develop horns, which are flat and short, and which lie upon the back of the head. The horns at a distance midway of the length curve outward. There is an entire absence of beard, and the "goat odor" so common in the males of other breeds is entirely wanting in this one, not even appearing at rutting time. The eyes are large and lie flat in the head. The color is glossy black or dark brown. Several authors

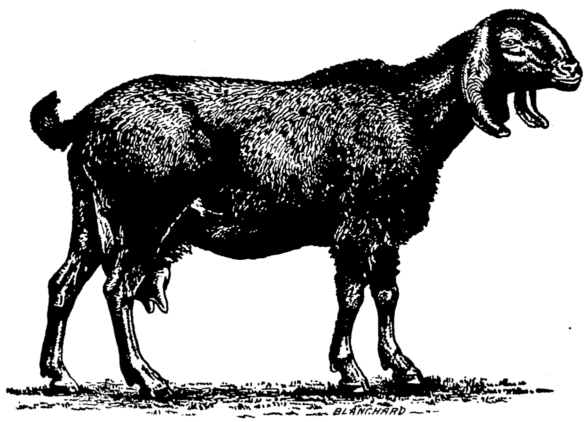


FIG. 49.—Nubian Goat. (Copied from Hoffmann.)

who are familiar with this breed assert that the hair is always short, while one, who is no doubt equally as well informed as the others, says the hair is long. The fact is that there are both kinds. Pegler describes it thus: "The hair is comparatively short in the male, but very much so in the female," yet he gives an illustration of a Nubian with long hair. It can hardly be doubted that the Nubian is closely related to some of the other breeds of northern Africa, all of which have long-haired strains among them. The skin is oftentimes much wrinkled.

The udder is deeply indented, or divided, so as to form very distinct lobes. The teats are situated, as in all species, on the lower part of the udder, but upon the outside.

The Nubian is the most peaceful and gentle of the goat family. It is not vagrant, and does not require delicate nourishment. The only objection that can be ascribed to it is such extreme sensitiveness to

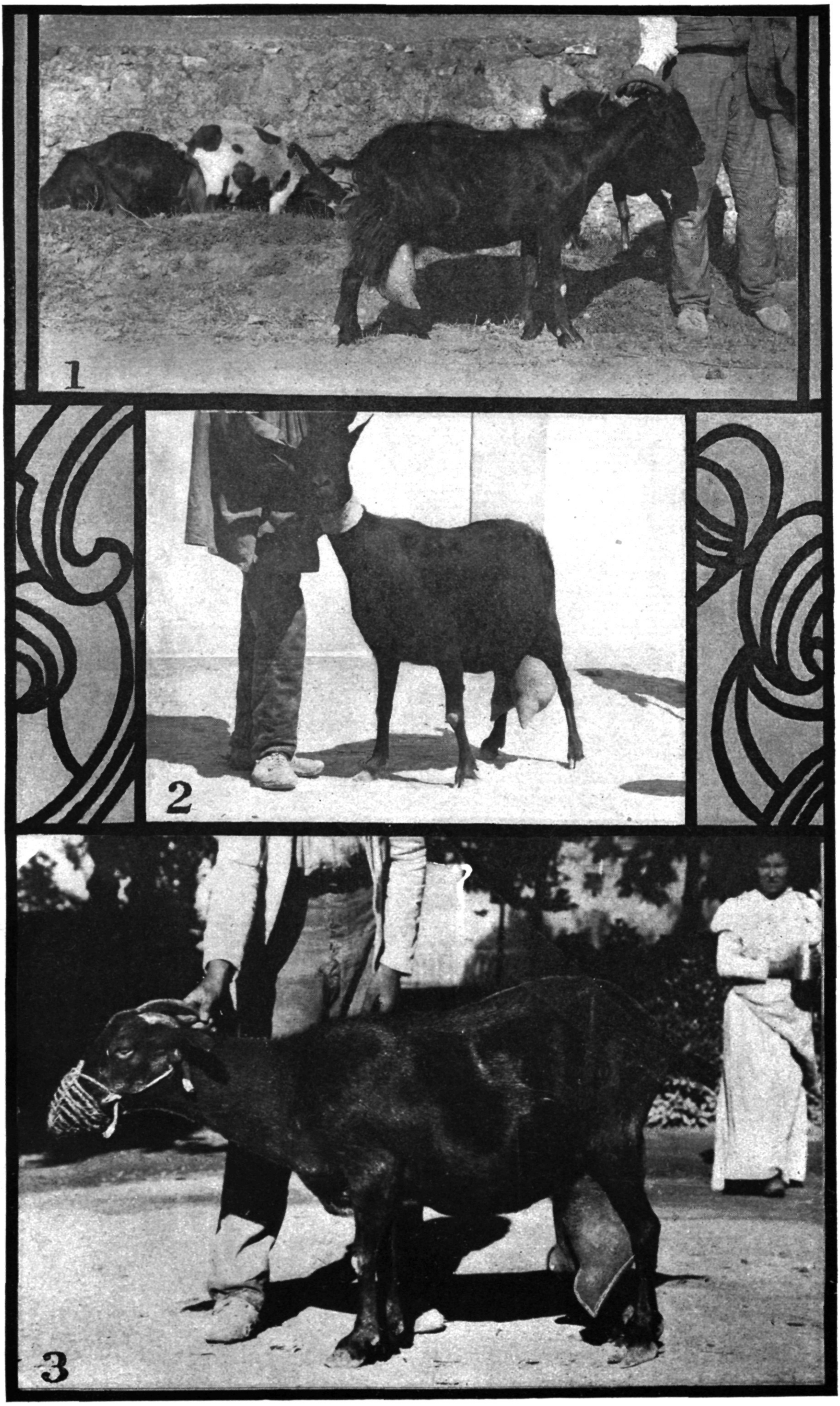
cold that it can with difficulty withstand the slightest degree. For this reason, in France and England, it is always provided with a warm house during winter, and never turned out in the morning when there is frost. It is said that the slightest cold produces abortion almost instantly.

Crosses have been made of Nubian bucks upon selected common does with results very satisfactory. The crosses have better developed forms than the common goats; they are more robust, and partake largely of the physical characteristics of their dams. It is a pleasure to quote here from a letter by Wm. G. de Coligny, of Springfield, Mass., who had experience with Nubian goats in Ecuador:

> Mr. Francisco Chiriboga, now deceased, a large cattle raiser in the province of Imbabura, northern Ecuador, had a flock of about twenty Angoras and one of Nubian goats, ten in number, which he imported from France, from the Government station at Souliac, department of Cantal. He used to cross them for the wool, milk, and meat. The Angora became fairly good milch goats, but not so good as the crosses from the Nubian upon the common goat. * * * The hair of the Angora-Nubian goats was not white, but very silky, fine, steeple pointed, and about 8 inches long; in some individuals 10 inches long.
>
> The amount of milk produced from three or four Nubian goats and their crosses at that time (1877) was about 4 liters per head per day. Milk from the Angora-Nubians was about 2½ liters per head per day, and from the Nubian and common goat cross, about 3½ liters.

Of all domestic animals, except the rabbit and the hog, in the language of Du Plessis, the Nubian goat is the one which increases most rapidly. A French writer (Sacc) says that he has known one of these animals to drop eleven kids in one year, four on two occasions and three at another. This, of course, is an unusual case, yet it can be safely affirmed that Nubian goats generally have kids twice a year, and frequently there are triplets.

Sacc avers that the daily yield of milk per animal is from 10 to 12 quarts, and that it seldom falls below 4 quarts; and that the milk is universally pronounced excellent and of a higher fatty content than milk from native goats. Du Plessis thinks Sacc has exaggerated by regarding the exception rather than the rule. It is nevertheless true that the Nubian goat is the highest type of milch goats. Du Plessis regards a good yield for the Nubian is from 5 to 6 quarts per day. He conducted some milking experiments for five days with two goats—one a pure Nubian and the other a crossbred Nubian and native goat. The results obtained are given on the following page.



Spanish Milch Goats.

Photographs by David G. Fairchild.

Production of milk by a Nubian and Nubian cross.

Day.	Nubian.		Nubian cross.	
	Quantity of milk.	Quantity of cream.[a]	Quantity of milk.	Quantity of cream.[b]
	Quarts.	*Quarts.*	*Quarts.*	*Quarts.*
First	4.6358	0.4012	4.7699	0.2223
Second	4.6569	.4063	3.6115	.2217
Third	4.7836	.4065	3.5376	.2212
Fourth	4.9315	.4191	3.8966	.2428
Fifth	5.2166	.4255	3.8966	.2534
Total	24.2444	2.0586	19.6383	1.1614
Average per day	4.8448	.4117	3.9276	.2322

[a] Butter, 8.41 per cent. [b] Butter, 5.91 per cent.

Given a suitable climate, proper feed, and intelligent handling, this breed will excel all others in milk production. So far as the United States is concerned, however, its area of usefulness in its pure state will be limited, it seems, to the extreme Southern States and southern California. This is the opinion of De Coligny, who is familiar with this breed. However, among goats imported into Canada within the past two years there is said to be a Nubian buck that is withstanding the cold climate of that locality. The tenderest care must be his lot if he is a pure specimen. The writer has been unable to obtain any information about this animal by correspondence, or indeed, about other breeds of the same importation. A few Nubians may be found in England, where their value has come to be recognized for crossing upon the common goats of that country.

The Egyptian, or Nile, goat.—The description given of the Egyptian goat (*Capra ægyptica*) is after Hoffmann. This goat has a small head and either short horns or none at all. It has a facial expression that is remarkable and peculiar. The nose is short and stumpy, the nasal bone bulging upward. The lower jaw is longer than the upper one. The beard is often wanting. The eyes are small; ears about as long as the head, are narrow and rounded at the end, and are pendulous. The color of the hair varies from reddish brown to light yellow, and always lighter in color on the belly than elsewhere. The goat odor is never present. (Note the similarity of this goat with the Nubian, the Syrian, the Mamber, and the Zaraïbi.)

The Egyptian goats are numerous in the Nile Valley as far as Nubia and Upper Egypt. They are regarded as among the best milch goats, and are said to give daily from 5 to 6 quarts of milk. Hoffmann says it has been claimed for this breed that a specimen has been known to give from 10 to 12 quarts of milk daily.

The African, or Widah, goat.—Löbe says the African goat in its conformation and peculiarities resembles the Angora, but is smaller. The short description given here of this goat is translated from the German of Hoffmann:

This goat is the most handsome and graceful of all goat breeds. It is of medium size and has a shapely head; has a robust, well-rounded, fleshy body, and better developed legs than any other breed of goats. The horns are thin and curve gently backward and outward, the point bending back again so as to form the beginning of a spiral. The hair is short and coarse; on the neck, back, sides, and legs it is black, but underneath it is yellow. The color may be reddish or yellow.

There is a subbreed of the African goat called the Dwarf goat (fig. 50). It is only 13 inches high and 26 inches long, according to Löbe, who makes no comment as to its value.

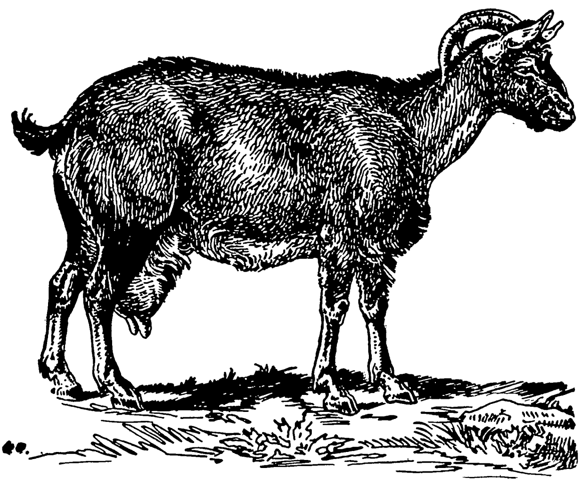


FIG. 50.—African Dwarf Goat. (Copied from Hoffmann.)

The Zaraïbi goat.—The illustration (pl. 41, fig. 3) shows a prize-winning Zaraïbi buck at one of the shows of the Khedivial Agricultural Society of Egypt. Nearly all travelers through Egypt who observe the live stock there mention this goat as a most excellent milker, and it always appears at the shows, yet no description of it is at hand. It is a large animal with long hair and especially characterized by its very long ears. The description of the Egyptian goat applies to the Zaraïbi pretty well, but the writer has been told by visitors to Egypt that the former, although a good animal, is not the equal of the latter, and also that the former are much more numerous. There is good evidence that this breed was originally from Syria.

The following report regarding this breed is from David G. Fairchild, agricultural explorer of the United States Department of Agriculture:

The Zaraïbi is the best milch goat known in Egypt and it is used largely by European families desiring pure milk for their infants. It not only gives more milk than

the ordinary kind, but is said to be a better breeder. I learned that the wealthiest landowner in Egypt had only recently purchased several for his own use. The best herd in Egypt is owned by the Khedive.

Mr. Fairchild was permitted to inspect the Khedive's herd of goats, a privilege seldom accorded to anyone. He believes they could with advantage be introduced into southern California in the warmer parts, but does not think they would live through the cold winters of the North unless housed very carefully. The climate to which they are accustomed is very much like that of southern California.

G. P. Foaden, secretary of the Khedivial Agricultural Society, forwards the following statement:

> The Zaraïbi goats are a race which was brought originally from Syria. They are superior to the native breed. They are now bred chiefly in the neighborhood of Cairo. A good average goat will give 4 pounds [quarts?] of milk per day and costs when full grown, if well bred, as much as £1.10 (about $7).

The Syrian goat.—The writer is unable to find an authoritative description of the Syrian goat, but the evidence given by travelers in that country is convincing that, all things taken into consideration, this breed must take a place among the best breeds for milk production. It is always long haired and in color mixed black and white or solid black. Its ears are very long and pendulous, making it easy to believe that it is the original stock of the Zaraïbi breed found in considerable numbers in the neighborhood of Cairo. The only available photograph (pl. 42, fig. 1) of this breed is the one given herewith, being one taken in Nazareth in April, 1904, by Mrs. Sallie Russell Reeves, of the United States Department of Agriculture. The flock shown here is owned by the German Orphanage and constitutes the only source of milk for that institution.

Dr. Ira Harris, who has been the American consular agent at Tripoli, Syria, for upwards of twenty years, has given the writer some interesting and valuable information regarding the Syrian goats, and some of the important parts are embodied in what follows:

This goat gives about 16 pints of milk a day, and the lactation period is usually nine months. It is a hardy breed, being kept all over Syria—on the plain, and on the mountain, where there is snow and frosty weather. "On the Hameth and Hums plain," says Doctor Harris, "they have a hot summer and a cold winter. I know of no other animal that has such a strong constitution unless it is a donkey." These goats are often seen in large flocks in Syria. Doctor Harris states that he has seen 2,000 kids in one flock.

It is likely that this breed could be easily acclimatized in the United States, and the low prices at which they can be purchased in Syria would seem to make it desirable for some one to consider the feasibility of importing some of them.

The Mamber goat.—The Mamber goat (*Capra mambrica*) is, according to Hoffmann, similar in many respects to the Cashmere [Angora?], but the horns, when they are present, are smaller. The ears are about three and one-half times as long as the head, are broad, thin, with the end rounded and turned up. The home of this breed is Asia Minor, especially in the vicinity of Aleppo and Damascus.

Hoffmann's description gives the impression that the Mamber goat is variously colored. The usual color is most likely black or brown, as it is probably closely related to the Egyptian and the Nubian goats.

The Sumatra goat.—The little that the writer has been enabled to obtain concerning the goats of the island of Sumatra is taken from Hook, who mentions them as scarcely larger than cats, and Hook says that, when contrasted with the large Pyrenean, the relation is much like that between the bantam and Cochin China fowls. It is hardly likely that there will be any desire to employ any of the Sumatra blood in building up a milch goat industry in the United States.

The Spanish-Maltese goat.—Under present conditions this goat would better be considered as among the American milch goats; but as they were bred as Spanish-Maltese several years before the other name was suggested, they will be treated separately here. (Pl. 31, fig. 3.)

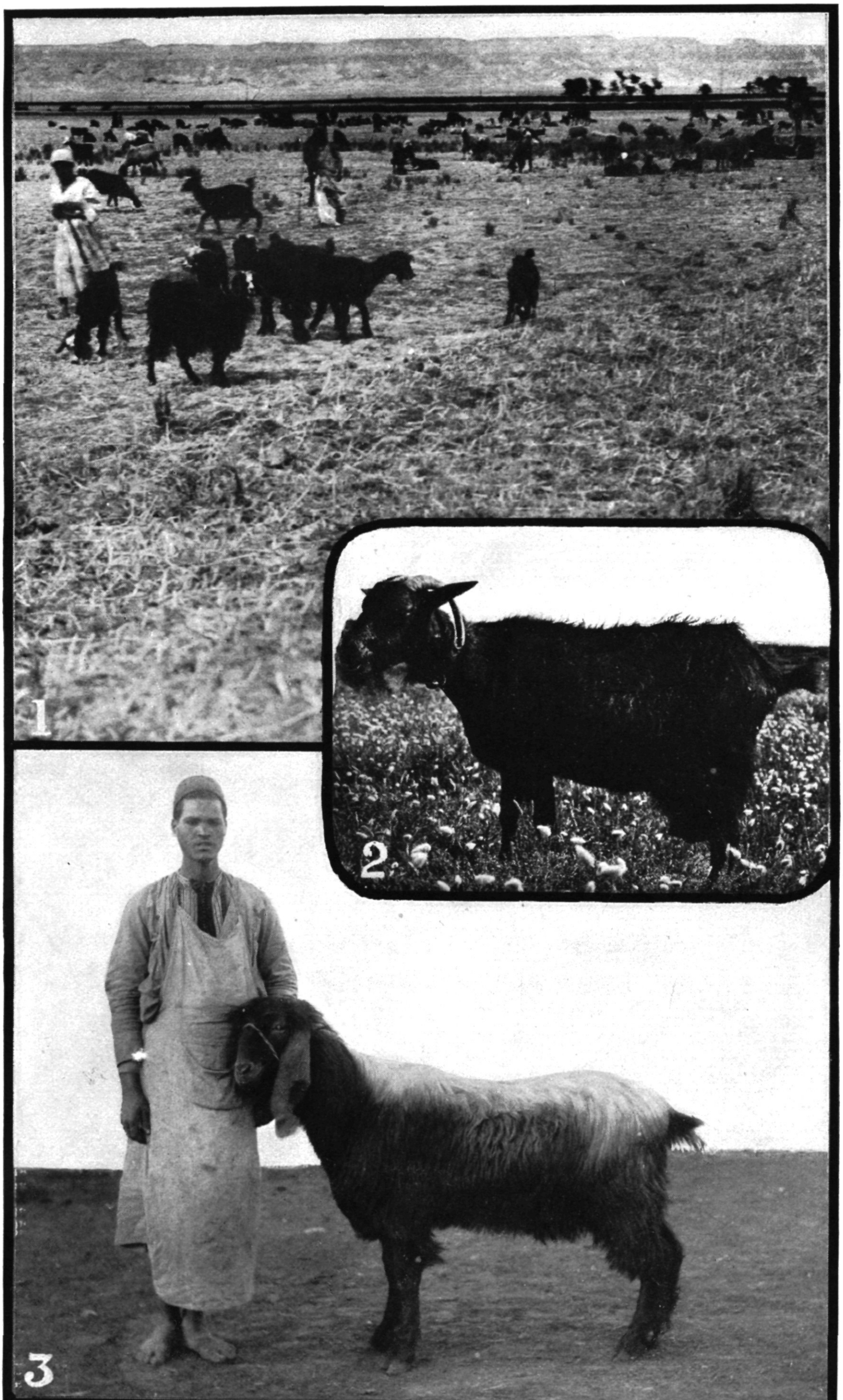
It is known that Spain at a former time received many goats from Malta, and it is claimed that some of these found their way to Mexico, and finally to Texas and New Mexico. Their history is difficult to trace accurately, however.

The following description of these goats is by B. H. Van Raub, of Texas:

> The Spanish-Maltese goat is about the average size of the common or the Angora goat, possibly a little larger. It is white or grayish in color, but many have brown, bluish black, or reddish spots. Many have coarse hair, some have long, fine, silken hair, and some have short, coarse hair. As a rule they have pendulous ears. There are more hornless, or muley, goats among the Spanish-Maltese than among any other breeds.

It may be true that this particular strain is less inclined to produce horns than the common American goats, but it is not the case when considered in connection with the best breeds of Europe and Egypt.

There is no information available as to the quantity of milk that these goats will yield, although 2 quarts a day for some indviduals has been estimated.



FIGS. 1, 2.—COMMON GOATS OF EGYPT. FIG. 3.—ZARAÏBI GOAT.

Photographs of figures 1 and 2 by David G. Fairchild.

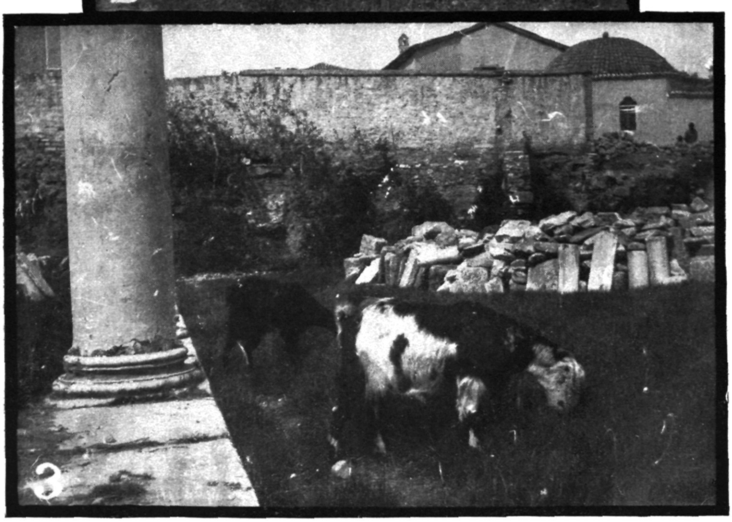


FIG. 1.—SYRIAN GOATS AT NAZARETH. FIGS. 2, 3.—GOATS AT ATHENS.

Photographs by Sallie Russell Reeves.

THE MILCH GOATS OF SWITZERLAND.

By Frank Sherman Peer,
Cornell Heights, Ithaca, N. Y.

In the spring of 1904, I had the pleasure of visiting Switzerland in the interest of several American gentlemen who wished to buy and import to this country some of the noted cattle and milch goats of that country. Armed with letters of introduction to the Swiss minister of agriculture, I arrived at Berne one day in March, full of delight at the magnificent scenery and anticipation of the work before me. The Swiss minister of agriculture sent me to the American consul as being the proper person to bring the questions before his department. The result was a letter to the president of the Swiss Agricultural Society, who in turn gave me letters to the best and most reliable breeders of milch goats in Switzerland.

It was soon learned that there were several breeds of goats in Switzerland, but that the best milking breeds were the Toggenburg, the Saanen, the Alpine, and the Schwarzthal,[a] and of these the Toggenburg and Saanen goats were the best milkers. Therefore I confined my attention principally to the last two varieties.

All the breeds which I investigated are about the same size and weight, except the Saanen, which are about 25 to 30 per cent larger and heavier than the others. As to a choice between the Toggenburg and the Saanen, I like the Toggenburg better for a close-at-hand inspection and the Saanen best when seen in the field. There can be no prettier sight than a flock of Saanen goats on a hillside or in a green pasture.

In 1903, there were exported from Switzerland 50,000 francs' (about $10,000) worth of Toggenburg goats, which speaks well for their popularity in foreign parts. Animals winning a prize are not allowed to leave the country or the neighborhood where raised for a year.

As to the quality of Toggenburg and Saanen goat's milk, so far as I could judge, there was no choice. They both give nice white milk, quite free from a goaty taste, which can not be said of all goats. It is seldom yellow and is probably the better for it. The best goat's milk, as I understand, is that which shows the greatest proportion of casein. Goat's milk in Switzerland is rarely made into butter.

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[a] Mr. Peer's descriptions of these several breeds are embodied in the text dealing with the breeds.—Editor.

The milk is considered good after the third milking, and the quantity rapidly increases for a few days after giving birth, when the maximum is reached. It usually continues for five or six months and sometimes for seven and eight months, when it gradually declines. A good goat may be expected to give 600 to 700 kilograms a year. The French feeding tests have proven that seven goats may be kept on the feed necessary for one cow, and that the seven goats will give much more milk than one cow.

GENERAL TREATMENT, FEED, AND CARE OF THE GOATS.

The goat of Switzerland is the Swiss peasant's cow, the Swiss baby's foster mother, a blessing to sanitariums for invalids, and a godsend to the poor.

Switzerland is a country of narrow valleys and lofty mountains. The winters in most parts are long and severe. The valleys are devoted to hay and grain to support the farm stock through the winter, while the foothills and mountains are the pasture ground during the summer months.

The highest mountains are covered with perpetual snow. Winter in the Saane and Toggenburg valleys sets in about November 1, and the ground from about that time until nearly May is covered with snow. When the writer visited there in March last the snow was from 3 to 6 feet deep on the level. Scattered all over the vale and on the foothills are little barns filled with hay, and this is either brought on hand sleds to some stable near the house, which, as a rule, is a part of the house, or the stock are moved from one barn to another, in turn, as the feed gives out. There are no large herds of goats owned by a single man or company, but nearly everyone has from 1 to 6. Ten or a dozen goats are considered a very large flock. The goats in winter occupy a portion of the cow barn or horse barn, or some warm stable adjoining the kitchen. As a rule, neither cattle nor goats go out of their stalls from the day they are put in in the autumn until the following spring.

The cows are usually fresh in the autumn after they come into winter quarters. Winter dairying is the universal practice. The goats drop their kids in the spring, beginning in March. About May 20, when the snow is gone from the valleys and the lower foothills, the larger herds of cattle are taken from the stalls and bells of different sizes and notes are put on their necks. One, called the "bell cow," wearing the largest bell of all, leads forth the herd to pasture. Together with this herd of cattle and goats, which belong to some larger farmer or breeder, go the cows and goats of a dozen or more neighboring peasants.

A cow man, with the "big bell" cow as leader of the flock, starts for the pasture fields; several boys go along as assistants. It is a great

day of rejoicing for cattle and goats and kids alike, after their long winter confinement. The gaily dressed cow men, the chorus of the bells, the sporting calves and skipping goats all make a very interesting spectacle indeed. These animals go yearly to certain locations on the foothills, and, as the snow gradually disappears, they keep moving the herd higher and higher up the mountains until midsummer, when they arrive at the limit of vegetation and shortly after begin the descent, and about November 1 they are all back in the stables again for the long winter.

Dotted all over these lofty mountain ranges are little huts which are the headquarters of the cow men and boys while herding in that particular vicinity. Once or twice a week someone goes to the valley to renew the larder with dried fish, canned meats, and bread.

There are scattered over these mountian ranges little creameries mostly for making cheese. The milk from the goats is mixed with that from the cows and made into cheese. In some cases, however, the calves born the autumn before are allowed to suckle their dams while in the mountains and the goat's milk with a little cow's milk only is made into cheese. There are therefore many brands of this mountain-made cheese, differing largely only in the proportion of cow's milk to goat's milk. The process of making these different kinds of cheese is generally the same.

Goats and cows seem to work well together on these summer pilgrimages above the clouds. The goats oftentimes go where cows can not, and they live largely on twigs and shrubs, which the cows do not eat.

The winter feed of the goats consists of a small wisp of hay daily and possibly a handful of oats or other mixed grains. As a rule, they do not get any more than sufficient to keep them in very ordinary condition.

As to priçes, Toggenburg goats from 1 to 2 years old in March, before dropping their kids, cost \$12 to \$15 per head; bucks, \$15 to \$25. Saanen goats of the same age cost from \$3 to \$10 per head more, and Alpine goats from \$3 to \$5 less, than the Toggenburgers. The Schwarzthal, or Glacier, goats cost from \$15 to \$20 for females and from \$20 to \$40 for males. Cheaper grades of goats, such as are usually exported through local dealers, may be had, but they are usually the culls.

Treatment of kids.—As a rule, the goats of Switzerland are allowed to breed only once a year, but where it is desirable to obtain the greatest yield of milk and the most increase, they may bring forth their young three times in two years. By this system the yield of milk is increased to an average of 1,000 kilograms (2,200 pounds) per year. The kids are usually allowed to suckle their dams for a day or two, the first milk being very necessary to the healthful movement of

the young kid's bowels. Twins are the rule, and sometimes triplets, and occasionally four kids are dropped at a birth. The best breeders prefer that the females be 2 years old when they drop their first kids; but they will breed younger.

When a young doe gives birth to twins she is generally assisted in rearing them by a nursing bottle and cow's milk, which is diluted nearly half with water and slightly sweetened. Usually, with a number of fresh milch goats on hand, the kids are separated from the dam (in fact, they are rarely ever allowed to run with their dams) and are taken one at a time and put upon another doe, so as to divide the quantity of goat's milk in accordance with their wants or age. When cheese making is the object, it is planned to have a fresh cow to bring up the kids, as above described, beginning always with goat's milk and reducing the quantity and increasing cow's milk and water as the age of the kid will permit.

Feed.—This milk feeding goes on for five or six weeks, when most of the kids are weaned from milk altogether. They are given a small quantity of hay to pick at when a few days old. The best breeders in Switzerland say that buckwheat flour, corn (maize), and a little warm water make the best grain ration for milch goats. Oats, ground and whole, are also fed.

SWISS MILCH GOATS IN AMERICA.

There are many reasons why the milch goats of Switzerland should find a welcome in the United States. First, their milk is the nearest to that of human mothers, or, at least, is such that the most delicate stomach can retain it. It can generally be taken freely where cow's milk would not be tolerated. In connection with sanitariums and for use in all acute stomach troubles, these goats fill a want that can not be estimated by dollars and cents. In this way probably they will find a footing in this country. They are the poor man's cow, as has been said before, and thousands of laboring men would find them a luxury for their homes and a godsend to their families.

The trouble will be that in this country the goat has so long been an object of ridicule among those who never understood its value that a false impression has sprung up among laboring men that is prejudicial to the keeping of goats. There are thousands of homes, especially in the mining districts, where herds of goats could be driven away in the morning and returned at night; and they would supply the homes with a most nutritious and most healthful beverage and food at a trifling cost.

Points.—In selecting any kind of milch goats there are some general rules that may govern. One of the most common faults is an inclination of the hocks, which causes the hind feet to turn, or toe, out.

Quality or fineness of hair is usually demanded; also thickness of coat. Another fault which is noticed among animals (on account of in-and-in breeding or neglect) is a dropping away behind the shoulders. Goats should have deep, full breasts, strong loins, broad backs, deep bodies, and large stomachs; these are the general requirements. Then comes color markings, and all that goes to constitute family type in each particular breed.

When we realize the wretched stabling and scanty feeding in Switzerland, it may confidently be expected that the goats will be greatly improved in every respect by good care, proper ventilation, and by liberal feeding. By such rational treatment they should be brought to a much higher state of perfection as milk producers.

Soil.—Neither a goat nor a sheep will thrive on soil that is at all damp unless thoroughly drained. While goats are said to live on anything or nothing, they are even more fastidious than sheep. They require a wide range. They pick the tenderest bits of grass and buds, and when they have fed over a ground once or twice the taint from their own bodies makes the pasture objectionable to them, and they keep on feeding there only by stress of hunger. Where a wide, hilly range or frequent change can not be given, they should be tethered and not allowed more pasture to go over in a day than they will eat. In this way they may always have fresh, untainted forage within a very small inclosure, or, better still, where a wide range can not be given they may have the run of a small inclosure and be fed soiling crops in the stalls during the day. In hot weather they should have stalls darkened to exclude the flies in the daytime and the liberty of a yard, paddock, or field at night. In spring and autumn they could go out in the daytime and remain in at night.

It must be remembered that goats are very sensitive animals, and, while they are, in jest, said to live on air and snow, they are, in reality, very susceptible to sudden changes of climate, cold storms while at pasture, and drafts while stabled. While they have a great stock of vital energy, their milk supply is more easily affected by sudden change and exposure than that of either cattle or sheep. In Switzerland the goats of the best breeders are housed at night, even after they go out to pasture, until the weather is thoroughly settled, when they are fed soiling crops by day and go out by night.

Stabling.—The milch goat has already attained quite a degree of popularity in England, and, while visiting that country during late years, I have seen some very complete stables and stalls, which seem to meet all requirements. The prime object in building a goat stable is, first of all, absolute dryness; stone basements or masonry walls, unless built hollow, should be avoided; second, ventilation, or plenty of fresh air without draft.

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NOTES ON THE ANGORA GOAT INDUSTRY.

By George Fayette Thompson, M. S.,
Editor of Bureau of Animal Industry.

Angora goats at the Louisiana Purchase Exposition.—The exhibit of Angora goats at the Louisiana Purchase Exposition (1904) was the largest, in point of numbers, ever held, and a large number of most excellent animals were brought together there. The writer was the juror for goats, and his official report is given herewith:

Angora goats were given a place in the live-stock exhibit of the Louisiana Purchase Exposition on the same basis that other domestic animals were exhibited. This was most gratifying to those who are specially interested in the substantial growth of this new industry in the United States. It was a recognition well deserved, and at the same time one of the many evidences of the broad-minded character of the management of the exposition.

Previous to this showing of Angoras at St. Louis, which was designed to be international in character, there had been held at Kansas City four annual exhibits under the direction of the American Angora Goat Breeders' Association. The goat breeders had attended these several annual shows at much expense, in order that they might derive from the comparison and competition there afforded the points necessary for the improvement of their animals. That they learned their lessons well and rapidly was exemplified by the presence in the ring each year of animals much superior to those shown the year before, a situation due to two causes—to better judgment in selecting breeding animals and to better breeding, so far as it could be brought into evidence in the short time.

The information gained at these exhibitions was utilized to the fullest extent by the goatmen in the breeding, selection, and preparation of their animals for the test at St. Louis. So it came about that the exhibit of Angoras at the Louisiana Purchase Exposition, not only in numbers, but in quality, exceeded any other exhibit that was ever held. The animals shown, with very few exceptions, were such as would rank with the prize winners at the previous exhibitions. There were no animals shown here with such outstanding merit as to surpass, to any considerable extent at least, the champions of some of the previous exhibits. Indeed, there is a question in the mind of the juror whether there had not been one or two previous champions which surpassed those shown at St. Louis. But the lot, considered together, was of exceptionally high quality and extremely satisfactory to those who are fostering the industry. The fact that there were so many animals of high merit made the work of the juror a difficult task. It seems to be appropriate in this connection, however, to state that the juror on goats at St. Louis had served with others in a like capacity at Kansas City at three of the previous annual exhibitions, where most of the breeders had met him and who knew his opinions; thus the breeders knew in a general way the ideal that was in the mind of the juror.

There went before the juror for examination (and reexamination for championship awards) 345 Angoras. Few people who are not breeders of these animals realize how much work the judging of this number required. A most careful examination must always be made of the fleece with reference to its density, luster, length, oiliness, freedom from kemp, etc.; it is impossible to do justice to a goat without such painstaking efforts. These conditions are hidden from the eye of the casual observer, and they explain why the juror's selection of prize winners did not in all cases agree with the judgment of some spectators.

The announcement was made by Col. Charles F. Mills, chief of the department of live stock, to the jurors on sheep and goats that the management of the Louisiana Purchase Exposition selected the jurors because of their special fitness to do the work in hand, and for this reason they were not in any sense bound by any former recognized standard or score card; that they were to award the premiums to those animals which best represented the purpose for which the breed is raised; in other words, they were to consider only the lessons learned from the past and to anticipate the future by fixing the type for which all breeders should aim. This was not so difficult with the Angoras as with sheep and other domestic animals, for the best Angora is yet far from being the ideal animal. It was not a difficult matter to know what was desired in the goat and how far the animals on exhibition fell short in desirable characteristics. The judging of the Angoras, therefore, was along the same lines that had been followed at the previous exhibitions at Kansas City.

The Angora goat, like other farm animals, must be judged with reference to size, conformation, and constitution; in addition, and more important than any other single point, the quality of the fleece must be considered. From an economic standpoint the Angora is primarily a mohair producer, and consequently it should yield that quality of hair which the staple trade demands.

A few years ago, before much effort had been made to improve the Angora, it was described as a little animal; but under favorable conditions its size has been greatly improved, although it is yet considerably smaller than the average sheep. This improvement has not always been at the expense of a fine fiber, as many at first expected it would be. The future may cause a change of opinion as to the weight that is desirable, but at this time it is believed that the aim should be to produce animals weighing at maturity from 100 to 140 pounds. Of course there are now individuals that will weigh up to 180 pounds, but this is very much heavier than the average is likely to be for many years yet to come.

The body should be round and broad throughout its length; hips and shoulders of equal height, as low shoulders indicate a weak constitution; hips not sloping in a pronounced degree; chest broad; legs strong, but not long. The head should be broad, with a wide muzzle and bright eye; ears may be partially upright or distinctly pendent.

The fleece should cover all parts of the body except the inside of the upper legs. While some animals show mohair down the legs to the feet, this does not indicate a better individual than may be found among those that have no mohair below the knees and hocks. This does indicate, however, a strain producing a larger fleece. A topknot is pretty, but does not indicate quality. The fleece should make an annual growth of not less than 10 inches and be so dense upon the animal as to yield from 8 to 10 pounds. It should be in ringlets well formed from point to skin, and the tighter these ringlets are twisted the better; loose, slightly wavy hair is objectionable and indicates coarseness and brittleness, and often there is lack of luster. It is of the utmost importance that the hair be

extremely fine—the finer the more valuable. The ideal Angora will be free from kemp. No other thing tends so surely to reduce the value of the fleece as the presence of kemp, and the more kemp there is present the less valuable the fleece, no matter how fine the mohair may be. It has been said that it is impossible to breed out this objectionable feature, but the improvement that has been made during the past five years gives reason for great encouragement. There are now a few individuals that are practically free from kemp, but while some of them are able to transmit this good quality others do not do so.

The value of the Angora as meat did not enter largely into the consideration of the juror. This was not because the flesh is not most palatable and nutritious, but because an animal which produces the proper quality of mohair is too valuable to slaughter. In a large flock there will necessarily be a considerable number of aged wethers and other goats of poor quality that should be slaughtered, and their merits as mutton stock may be determined by the same rules that govern mutton sheep. The aim of the breeder is to secure the best possible mohair producers, and therefore the question as to whether an animal had the mutton quality was not given much weight.

Imports of mohair and Angora goatskins.—Occasionally fears have been expressed that the development of the Angora goat industry would soon result in an oversupply of mohair and thus a consequent check to goat raising. The importations for the last four years indicate that the demands of this country for mohair are far in excess of the production. Note the situation as shown in the following table, which gives the imports of "hair of the Angora goat, alpaca, and other like animals:"

Imports of goat hair for the fiscal years 1901–1904.

Fiscal year.	Pounds.	Value.	Value per pound.
1901	739,419	$238,459	$0.322
1902	793,649	233,275	.294
1903	1,243,749	409,727	.329
1904	2,231,340	643,850	.289

The Department of Commerce and Labor does not give the figures for mohair and alpaca hair separately, but it is not believed that the amount of imports of the latter are large. No effort has been made to ascertain even approximately the amount of mohair of domestic production for the year of 1904, but it was not far from 2,400,000 pounds—more rather than less. This indicates an annual consumption by our mills of about 4,500,000 pounds. We shall need a half million more goats than we now have in order to produce as much mohair as we are now importing.

It should be remembered that the value of imported mohair is fixed at the ports of export. To arrive at its value here there should be added the expense of shipping and the duty of 12 cents per pound.

Angora goatskins are admitted duty free. The amount so im-

ported in 1903 was 148,940 pounds, valued at $23,940, or 16 cents per pound; in 1904 the amount was $3,231, or 18 cents per pound. At this price these evidently were very poor skins, for the imported skins of common goats for the same years were worth 29 and 28 cents, respectively.

Remarkable mohair yields and prices.—Among the Angora goats exhibited at the Louisiana Purchase Exposition in October were two goats which, because of the long fleeces that they carried, attracted more attention than any of the prize winners. One of these was a doe owned by Mrs. M. Armer, of Kingston, N. Mex.; the other, Kingston Lad, was the property of Tom Wedgwood, also of Kingston.

Mrs. Armer's doe sheared 14 pounds. The length of the staple is not stated, but the longest of it was about 18 inches. The mohair was sent to a purchaser in New York City who fixes his own price upon long mohair; he buys all he can find in this country and imports largely besides. He uses the hair in the manufacture of various things, such as wigs, switches, nets, ornaments, flowers, etc. The following is his payment to Mrs. Armer:

2 pounds, at $5	$10
7 pounds, at $4	28
5 pounds, at $1	5
Total	43

Mr. Wedgwood's buck sheared 16 pounds. Ten pounds of this he sold to the gentleman already referred to, at $5 per pound, and 6 pounds he still holds. The owner says he gave away ringlets from the buck at St. Louis to the amount of 2 pounds at least. Most of the fleece was over 20 inches long.

In this connection it is interesting to note that a considerable number of persons in various parts of the country have sold whatever very long mohair they raised for very high prices—all of it to one man. For instance, William Riddell & Sons, of Monmouth, Oreg., sold 25 pounds for $42, as follows:

3 pounds, at $3	$9.00
5 pounds, at $2	10.00
15 pounds, at $1.50	22.50
2 pounds, at 25 cents (waste)	.50
Total	42.00

It seems that there would be a limited demand for mohair for the purposes for which this very long staple is used, and that this demand will be entirely satisfied in a few years, for the number of goats that can produce such long hair and carry it from eighteen to twenty-four months are increasing; but who knows how many ways may be

discovered for using the long staple? So long as there is a demand for a particular quality of mohair at such great prices, the breeders will be wise if they endeavor to supply it.

Prohibitive export duty on South African goats.—In 1901 South Africa passed a law which is usually referred to as "the Angora export duty act, 1901," a copy of which is not available at this office. This act provided for an export duty of £100 ($486.65) on each Angora goat and each ostrich, and was to go into operation when the several governments of South Africa should agree upon a simultaneous date. During the years that have intervened the law has not been in force because Mozambique and Natal held aloof, but on September 20, 1904, Mozambique issued a decree ratifying the export duty. This was followed by a proclamation by the governor of Natal on December 13, 1904, providing that the law go into effect on January 1, 1905.

The effect of this law in operation is practically to prohibit further exportation of Angora goats from South Africa. Several American breeders were endeavoring to make importations during the summer of 1905, but very few of them will now give the matter any further thought.

Angora goats in Porto Rico and Cuba.—Two years ago a few head of Angora goats were shipped from Maryland to Porto Rico, and the report comes back that they have done well there. In the last autumn Dr. N. S. Mayo, formerly professor of veterinary science in the Kansas State Agricultural College, but who was recently appointed chief of the new bureau of animal industry in Cuba, took some Angoras to that island with him, and they are reported as doing very well, indeed. The object of the efforts made to introduce these goats into these islands is threefold—the production of a quality of meat that is superior to that of the common goat, the production of fleece, and for the destruction of brushwood.

Lost goats surviving winter.—The Bureau of Animal Industry received recently a letter from N. B. Powers, of Vermont, in which that gentleman tells of 8 Angora wethers that escaped from his pasture in the autumn of 1902. In the spring 6 of them were found alive and well, having remained in the mountains unseen all through the winter. A similar experience happened to C. P. Bailey & Sons Co., where a fine buck was lost in Nevada in the fall, but was found in good condition in the spring. So, too, Kingston Lad, which produced 10 pounds of 20-inch hair, mentioned in another paragraph, was lost one winter in New Mexico, and first came to notice in the

Fig. 1.—Sultan, Grand Champion Angora Buck at the Louisiana Purchase Exposition.

Bred and owned by C. P. Bailey & Sons Co., San Jose, Cal.

Fig. 2.—Edna, Grand Champion Angora Doe at the Louisiana Purchase Exposition.

Bred and owned by F. O. Landrum, Laguna, Texas.

spring when he wandered into a strange goat corral a hundred miles from his home. Besides these there are several such accounts in the records, some of which seem almost incredible.

The goat dog.—The following paragraph, from John B. Carrington, who reported it to the Fort Worth Daily Live Stock Reporter, is interesting:

> Dogs are often employed in herding, and in Texas there is already developed a more or less distinctive type, known as the "goat dog." He is a cross between the collie and the ordinary hound, and is an animal of wonderful sagacity and fidelity. These dogs go with the goats all day and sleep with them at night. With fearless devotion they attack any intruder, whether wild animal or man, and often die defending their charges. On some of the smaller ranches dogs do all of the herding, taking the flock out in the morning and bringing it in at nightfall. I remember encountering one of the dogs at the close of an autumn day when he had eaten nothing since morning, and tried to entice him from his goats with a tempting piece of venison. He rushed up the opposite bank of the little stream that separated us, barked furiously, then dashed back to his goats. The ranchmen have a saying that one goat dog is worth three herdsmen.

Goat raisers recognized.—The Angora goat raisers have never met with opposition from the raisers of other kinds of live stock. This fact has gratified them very much. The goat raisers are recognized in the constitution of the recently organized National Live Stock Association of the United States.

Grand champions at the Louisiana Purchase Exposition.—The grand champion buck at the Louisiana Purchase Exposition was Sultan, bred and owned by C. P. Bailey & Sons Co., San Jose, Cal.; the grand champion doe was bred and owned by Mr. Frank O. Landrum, Laguna, Tex. Good pictures of these animals are shown herewith.

A CONSIDERATION OF MOHAIR AND MOHAIR GROWING, WITH NOTES ON OBSERVATIONS IN SOUTH AFRICA.[a]

By GUSTAV A. HOERLE,
Chester, Vt.

In South Africa the breeders of goats judge their animals upon points, which are different from our judging, and have bred in a different direction from our breeders, both of which matters I fully indorse except as to the matter of general shape and symmetry. They do not like a long body and short legs so well as we do in the United States, and their goats would appear to many of our breeders as more or less leggy. Though their registry regulations do not mention any point for foretop, mohair specks around the eyes, and mohair on all the legs and on the ears, which a good register should recognize, the best animals show more or less of these fancy points. Most prized of all is the mohair tail, as it usually indicates denser covering along the back; then mohair legs, especially the front legs, which become covered two or three generations later than the hind legs; then mohair foretops, mohair specks, and, last, mohair on the ears.

That a mohair foretop is not so very much valued in the colony, we may judge from the fact that the sweepstakes champion at the Port Elizabeth show in 1899, a yearling buck, bred by R. C. Holmes, was perfectly bare on the face. Yet A. B. Hobson, the winner of the championships for both 1903 and 1904, liked the style of the mohair of this buck so much that he bought him for a high figure and afterwards refused $550 for him.

On the other hand, many of the best South African Angoras have hair enough on their faces to satisfy even the most fastidious American taste. This we can see from many of the illustrations in Schreiner's book; also from the photograph of Rhodes and others in the possession of the writer.

The photograph of Rhodes was presented to the writer by W. J. Edwards, one of his owners. This buck sold for $1,900, and was for

[a] Mr. Hoerle has made two visits to the mohair-growing sections of South Africa; and on May 29, 1904, he landed at New York with 147 head of Angora goats from that country. His observations and conclusions, given in this article, are published because of their interest to the goat men of the country, but the Bureau of Animal Industry assumes no responsibility for them.—EDITOR.

a long time considered by the greater number of South African breeders as the best animal ever imported to the colony. He came with the importation of 1896, but the most prominent breeders of to-day do not think very much of him, and, although they all admit his beautiful appearance, they say that many a prior importation had contained far better animals and that in the very importation that brought him there were several better goats which brought much lower prices. Though Rhodes was a very taking goat and made an excellent appearance from a distance, he could not bear a close examination.

I do not doubt that any fancy point can be gradually inbred in much less time than is required for the generally useful points. My visits to the Kansas City fair have fully convinced me of this, as many goats were there with faultless faces, but with very deficient, weak, and bristly backs and with utterly bare bellies. At the time of my first visit to Cape Colony, which was three years ago, the American idea about mohair faces was regarded there as being funny, and goats that were fully fleeced up to the middle of their jaws were held in light esteem unless they also possessed more valuable qualities. Quite a number of A. B. Hobson's otherwise best-covered does were almost bare on the face. This gentleman said that he appreciated fancy points, but what he was breeding for was a greater number of pounds of a certain quality of mohair. It must be confessed that this idea seemed to be the more practicable. In contrast with Mr. Hobson's bare-faced goats there was a full-mouthed buck belonging to his neighbor which had a silky and soft mohair face, but its body was covered with what looked more like horse tails than mohair. This buck his breeder kept as a curiosity and not for breeding.

Thus the more an animal combines the fancy points with those of real practical value the more valuable he becomes.

But what are those practical points that make an Angora goat valuable? First, I regard as most valuable the density of covering—that is, the greatest possible number of hairs to the square inch—the evenness of this covering, the length of the staple, and the tensile strength of the hair, then fineness of the hair, and, finally, its luster. Luster and fineness are of less importance than density of covering, for there is hardly any mohair grown in the United States that has not sufficient luster for use in some sort of fabric. Besides, lack of luster is due more to the ill effects of climate and soil than to breeding.

In South Africa kemp is less frequent and much shorter in the best goats than in those of poorer quality, but there, as everywhere else, it still exists. With regards to kemp (which is not confined to goats, but is found on sheep also), it may be mentioned that, no matter what the color of the mohair may be on a goat, the color of the kemp, with very few exceptions, is always leaden, or dull white.

There is room for much doubt about the value of long mohair—the kind used by wig makers—as a high-priced special article of commerce. When the limited demand for this kind of mohair is compared with the amount that will soon be produced in this country, it would seem that the price is bound to be much lower than at present. Indeed, one consumer of this long hair in this country recently bought 800 pounds of it in South Africa at a shilling (24 cents) a pound.

A length of 6 or 7 inches is required for ordinary combing hair, while in some special fabrics hair from 8 to 10 inches in length is used. In the mills hair of greater length does not bring a higher price. Lengths above 12 inches are difficult to work and often need to be cut. Thus the practical value of those animals which produce hair 12 inches or more long lies in the fact that they may give two clippings of ordinary length in one year. With nonshedders an otherwise yearly growth of 11 inches could probably be clipped in two 6-inch fleeces, and one of 15 or 16 inches long in two clippings of 8 or 9 inches each.

The length of staple of our best animals can be considerably increased in four or five generations by the careful selection of breeding stock and proper methods of feeding. Every observing breeder knows that during the first three or four months the hair of yearly shedders grows much faster than that of nonshedders. After that for six or eight weeks it gradually grows slower until it finally almost stops. During the winter it grows only perceptibly when the animals have been shorn in the fall, and even then so slowly that from the beginning of December till shedding time there is rarely a longer growth than 1 inch, no matter how well they may be kept. Nonshedders at their best and even when kept in good condition will probably put on for several months from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches per month, then from 1 to $1\frac{1}{4}$ per month for two months, and finally to three-fourths of an inch or 1 inch; so that the total will amount to between 11 and 16 inches for the entire year.

The South African register requires a minimum length of fleece of 12 inches a year. Only goats of finest hair and greatest density of covering are accepted, and these usually have shorter hair than that of the coarser-haired animals.

The opinion is unanimous among South African breeders that a fairly well bred Angora should not shed under normal conditions; that is, even conditions of feeding and temperature. One of the most frequent causes of shedding is the change from dry to green feed. Such a change caused the goats of my two importations to shed after they were landed. Angoras kept in the South are often subjected to similar changes when, after a prolonged drought, rains start the new vegetation. This is the reason that the goats have appeared to be shedding twice a year in the South.

The shedding process of my imported goats last summer was very peculiar. The goats had been clipped in South Africa at three different times. Some bucks and does (the show animals) were sheared at the end of February or the beginning of March, 1903; the bulk of the does in October, 1903, and the stock bucks and kids at the end of February, 1904. After they began their journey the mohair stopped growing with some. The first sign of shedding was observed in two long-haired yearling does about twenty days after their arrival in New York; about ten days later quite a number began to shed about their heads and throats. They were all sheared except eight or nine, which were kept for observation. There was not much difference between the rapidity of the shedding process between the sheared goats and those not sheared. All had shed some hair on some part of the body—some around the head and throat, some along the back or on the belly, and others from head to tail; some on head, throat, and belly; several kids on the face and behind the horns only. Most of them shed all their hair, but very irregularly. Almost all of these continued their growth of mohair after a standstill of six or eight weeks.

A case of peculiar shedding that is remarkable I saw shortly after my first arrival in the Angora districts of the colony. In the buck pen of Mr. J. J. Cawood, of Mount Stewart, I saw a number of animals, looking as if they carried nearly a year's growth (about 10 to 12 inches) of hair, but this was very thin, and between the long mohair there was almost an equal amount of hair measuring about 3 inches in length. On inquiry, I was told that the winter season (our summer) had been very dry, but that in September there were some very heavy showers, causing the grass to grow luxuriantly. This condition caused the goats to shed; then a new drought began, the food became dry once more and the shedding stopped, with the result that those hair bulbs which had shed out began to produce a new growth; hence the peculiar appearance of the goats.

At South African shows not always the best animals or best pen of animals entered necessarily take the first premium, but receive such premiums as the judges consider they deserve. The first consideration with the judges is whether or not an exhibit is worth the premium. Often no first, but only a second or third prize has been awarded, or else a first but no second and only an honorable mention. I believe this to be a very just and reasonable way of acting, and which it might be advisable for our association to adopt for our shows. When brought to the ring the judges give a general glance at every exhibit in order to satisfy themselves that all present are worthy to be examined. Those which have not a generally satisfactory appearance are turned out. The next step is usually to examine the length of the mohair along the back. If this is not full length, the goat is either

turned out or marked accordingly. Then the fineness of fiber as well as the density of growth, evenness of covering, and the types of mohair on the different parts of the body, are compared. Too great a difference is not allowed. Long breech is considered especially desirable. A few South African goats have longer hair there than on any other part of their bodies. Then other points are considered, especially as to length and frequency of the kemp hairs. As I have observed elsewhere, fancy points may be considered, but there are no special points allowed for them. (This I consider a grave mistake. I believe that each single fancy point should be considered and allowed for separately.) After this the sum total is drawn, and if the necessary percentage has not been obtained the animal is rejected either for a premium or admission into the register.

The South African register is, no doubt, an admirably arranged institution, although for practical purposes in the United States it would not do in its present shape. It takes three examinations to pass a goat into the register—one as a yearling, one as a 2-year-old, and one as a 3-year-old. Each examination is very expensive ($5 per day and all traveling expenses, and these latter are very high in the colony). This high cost of having goats registered has kept many breeders out of the association. Why, then, not make one examination at 3 years old?

In March, 1904, the beginning of the eighth year of the register, there were only about 350 living Angoras of both sexes which had passed three examinations, and from 1,200 to 1,400 which had passed either the first alone or both the first and second examinations. The great stumbling-block is usually the required fineness of fiber. This usually degenerates so fast in the alkaline districts of the colony that no sweepstakes champion has been able to be registered. It must be evident that registered goats are rarely sold, and, if they are sold, they are goats which always cost three figures in pounds sterling.

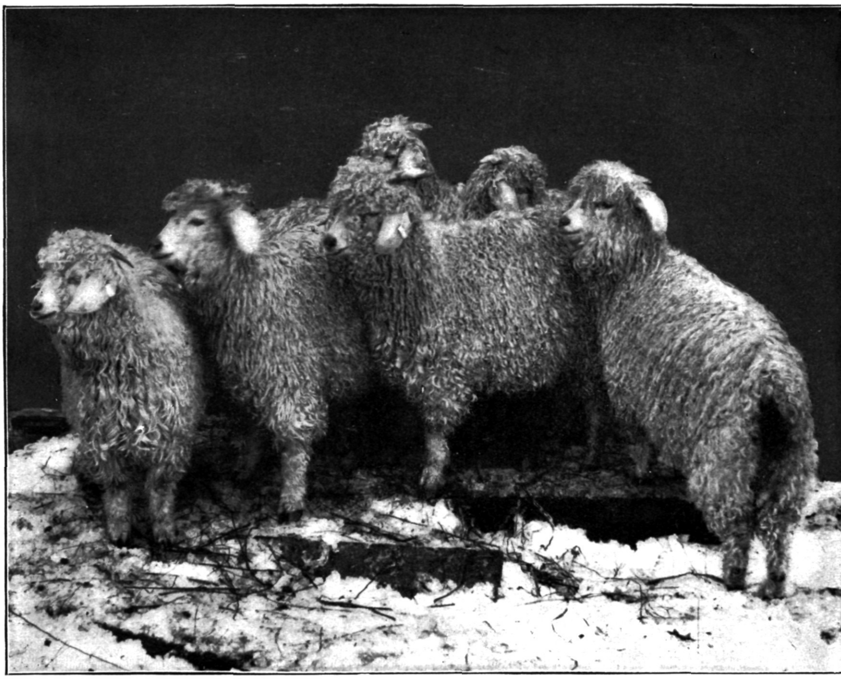
I quite agree with the Cape men that a register should admit only the best; a country which can show only 350 fully admitted animals in seven years is rather more ideal than practical. It also works more to the advantage of the man with the large bank account than to the breeder at large. No doubt it is better to register only about 300 out of over 2,500,000 females in seven years than to do as we did—admit over 50,000 out of about 750,000 female goats.

What we need is a "happy medium," which protects all breeders alike. This can only be obtained by a classified system of registering, in which the necessary points for general entrance are low, say from 35 to 40 points, but which rise rapidly when the higher classes are reached. Certificates issued by such a register would inform any would-be purchaser as to what class of goats he is paying his money for.

FIG. 1.—ANGORA DOE KATIE, A SOUTH AFRICAN YEARLING WHICH SHEARED 10¼ POUNDS.

FIG. 2.—ANGORA DOE MAUD, A SOUTH AFRICAN YEARLING WHICH SHEARED 9¾ POUNDS.

FIG. 3.—ANGORA BUCK RHODES, A SOUTH AFRICAN GOAT WHICH SOLD FOR $1,900.



KIDS FROM SOUTH AFRICAN ANGORAS.

Photographs furnished by G. A. Hoerle.

Several of the most prominent Cape breeders, some of which were examiners for the register, agree with me on the above points, and said that should the American association come to a reasonable system of registering they would be willing to do everything in their power to have the Cape register meet us halfway.

I once stated, nearly 30 years ago, that I believed that Angoras would eventually be covered as fully as Merino sheep. My recent observations in South Africa, as well as in this country, have strengthened this belief very much, and I think that our scale of points should pay special attention to this as one end to be attained, without, of course, neglecting the constitution, milk-giving quality, size, etc.

In some of the photographs which Mr. A. B. Hobson, of South Africa, has sent to this country, out of five goats shown there is only one which is fully fleeced up in the face, but the breeches of all of these goats are phenomenal. I do not think that there is another flock in South Africa that can boast of such breeches and on such a large number of goats. Mr. Hobson is, of course, very proud of this feature or he would not have had these photographs of partly bare-necked goats sent over to this country. However, when we compare these goats with those of his which took premiums, we find that the latter do not show the slightest deficiency in the covering of their faces. If we consider that the champion of 1899, at Port Elizabeth, had a bare face and that Mr. Hobson's flock averages over 10 pounds of hair yearly, we must acknowledge that South Africa advances rapidly in the science of goat breeding. Of course, the American breeders have also advanced during that time, and it is a credit to them that they have reached their present standing with such scanty importations.

Last, but not least, with the present rapid progress of the husbandry, a goat which may justly be considered as first-class to-day will be behind the times six years hence.

THE EXHIBIT OF THE BUREAU OF ANIMAL INDUSTRY AT THE LOUISIANA PURCHASE EXPOSITION.

By JAMES M. PICKENS and J. WILLIAM FINK, D. V. S.,
Of the Bureau of Animal Industry.

The largest and most comprehensive exhibit of the work of the Bureau ever prepared for the public was that shown at the St. Louis exposition of 1904. It illustrated the character, variety, and extent of the work carried on by the Bureau throughout the United States for the benefit of the farmer, the stock raiser, and the consumer of animal products, as well as for the encouragement of domestic and foreign commerce.

The exhibit was located in the northwestern portion of the Government building and occupied 3,100 square feet of floor space. In the preparation and arrangement it was sought to combine practical and instructive features with a pleasing artistic effect. An ornamental structure of woodwork inclosed the exhibit, and this structure was surmounted by a decorative frieze made up of a series of oil paintings of selected types of farm animals. The structure and frieze formed a very attractive setting for the whole display. Another prominent decorative feature was a large painting of the quarantine station at Athenia, N. J. On the wall was a large map of the United States, indicating the points at which inspectors of the Bureau are stationed, the class of work carried on at each place, and the area of territory infected with Texas, or Southern, cattle fever.

The exhibit was planned and prepared under the general supervision of Dr. Edward B. Jones, chief clerk of the Bureau. The decorations and most of the paintings were executed and the ornamental structure designed by Mr. Albert L. Pitney, who also superintended the installation of the exhibit. The pathological specimens and some other portions were arranged by Dr. J. William Fink, who explained to visitors the work of the Bureau. The dairy exhibit was arranged by Mr. Clarence B. Lane, assistant chief of the Dairy Division.

MEAT INSPECTION.

The meat-inspection service, through which the Bureau guards the wholesomeness of an important part of the food supply of the people of the United States and their foreign customers, was well repre-

sented by samples, models, pictures, and practical demonstrations. This is not only the largest branch of the Bureau's work, and the one in which the most of its employees are engaged, but in magnitude it far surpasses any similar undertaking by any government in the world. Nearly 40,000,000 animals are inspected every year, most of them being examined both before and after slaughter. The inspection service is carried on at 152 establishments in 51 cities. The inspectors who pass upon the health of the animals and the fitness of their flesh for human food are educated and trained veterinarians.

The method of marking meat after it has passed inspection was shown in the exhibit by full-size plaster models of beef carcasses bearing the official stamps and tags by which inspected meats may be identified in the markets by the public. From twelve to fourteen labels are placed on various parts of the carcass, so that when it is cut up each section will bear the inspection stamp.

The microscopic inspection of pork for the parasite *Trichina spiralis* was practically demonstrated by three microscopists, who daily made public examinations of samples of fresh pork obtained from St. Louis abattoirs. The manner of cutting samples from the carcasses and the preparation of the slides for microscopic examination were shown. A specimen of condemned pork containing trichinæ was kept in a microscope arranged for the inspection of visitors. This part of the exhibit attracted considerable attention and was nearly always surrounded by an interested throng. An attendant explained the nature and objects of the inspection, and the life history of the parasite and its relation to the health of human beings.

The trichina parasite which infests hogs may cause a disease known as trichinosis in man if the pork is eaten without thorough cooking. As the people of the United States are not in the habit of eating raw or rare pork, this microscopic inspection is not considered necessary for meat for domestic consumption, and is only applied to pork intended for export to certain countries which require such inspection. Our exports of microscopically inspected pork within the last ten years have ranged from 9,000,000 to 120,000,000 pounds annually, and this trade is made possible only by this inspection. Specially qualified and trained women are employed as microscopists. Out of more than 1,500 samples examined during the exposition, only 1 per cent were condemned for trichinæ. In the entire microscopic inspection for the year ended June 30, 1904, live trichinæ were found in but 0.84 per cent of the carcasses examined.

The general (not microscopic) meat inspection is not confined, as some suppose, to meat intended for foreign and interstate trade, but covers the entire product of all the abattoirs and packing houses where it is established. While the Federal law specifically provides

only for the inspection of products for interstate and foreign commerce, as a matter of fact it is usually impossible to determine at the time of slaughter whether any particular carcass will be sold and consumed locally or be shipped to another State or country; and so the Bureau, before instituting inspection at any abattoir, requires an agreement from the proprietor that the entire product shall be subjected to the inspection. Every animal or carcass or part which is condemned on account of disease or for other cause is disposed of in such a way as to prevent its use for human food.

An exhibit case contained a display of the various articles and appliances used in the inspection of meat and live animals, such as tags, brands, labels, stamps, certificates, sealing presses, sample boxes, compressors, etc.

INSPECTION OF ANIMALS FOR EXPORT AND OF VESSELS CARRYING THEM.

The work of the Bureau in encouraging and protecting the export trade in live animals was illustrated by a model of a stock yard, showing the inspection and tagging of cattle for export, and by a model section of a cattle-carrying steamer.

The stock-yard model showed the arrangement of the pens and the narrow passage, or chute, through which the animals are passed for careful inspection and tagging. Small figures represented the inspectors and the cattle, showing as nearly as possible how the actual work is done. Cattle that pass inspection have numbered metal tags placed in their ears for purposes of identification.

The steamship model included a stock car and pier and showed the manner of transferring the cattle from the cars to the steamer, also the fittings required by the Bureau regulations for vessels engaged in carrying cattle abroad. These fittings are designed to provide security, comfortable space, and sufficient ventilation for the animals. They are usually made portable and may be easily cleaned and disinfected at the end of each voyage.

Since the Bureau began its supervision over this traffic the conditions have vastly improved. At one time the trade was threatened with extinction because of alleged disease in American cattle and because of the heavy losses of animals in transit. As a result of the Bureau inspection, American live stock now has a better reputation for health, the losses in transit have been reduced to insignificant proportions, the animals are more humanely treated, the inferior vessels have been provided with proper fittings or forced to abandon the cattle-carrying trade, insurance rates on exported cattle have been reduced from 8 per cent to one-half of 1 per cent or less, and the volume of trade is growing.

Most of our export trade in live stock is with Great Britain. In the fiscal year 1904 there were exported, after inspection, 414,320 cattle, 241,294 sheep, and 2,649 horses. This was an increase over the previous year of 43.7 per cent in the number of cattle and 116.5 per cent in the number of sheep.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

The large painting of the animal quarantine station at Athenia, N. J., gave an excellent idea of the facilities and precautions for preventing the introduction of contagious disease with imported live stock. The picture and an accompanying ground plan showed the arrangement of the various isolated stables, barns, and lots, the streets and roadways, and the principal buildings. Animals imported through the port of New York are taken to this station and held in quarantine for a sufficient period to determine whether they are free from any disease which might endanger our native stock. The stables and yards are so separated that different lots of animals that may be in the station at the same time do not come in contact with each other or pass over the same roadways.

The station at Athenia is the largest and best equipped, but there are other quarantine stations on the seaboard. By means of a rigid inspection and quarantine of imported animals at these stations the Bureau has succeeded in keeping out of the United States the worst of the animal plagues that have caused heavy losses to the live-stock interests of other countries. Even in the case of the outbreak of foot-and-mouth disease in New England in 1902–3, it is practically certain that the contagion was not brought in by live animals.

SUPPRESSION OF ANIMAL DISEASES.

The several lines of work conducted by the Bureau for the control and eradication of the contagious diseases existing among the live stock of the United States were well illustrated in the exhibits. Sheep scab, cattle mange, Texas fever, and blackleg are the principal diseases engaging attention at present.

SHEEP SCAB AND CATTLE MANGE.

Two mounted specimens of sheep illustrated in a realistic manner the appearance of the disease known as scab, or scabies, and the damage which it causes to the fleece. One of the specimens showed the early stage of the disease and the other the advanced stage. Two greatly enlarged wax models represented the male and female of the parasite which causes the disease.

Large models of a sheep corral and dipping vat showed the method of treating large bands of affected animals. Being inclosed in a corral, the sheep are driven in small bunches through a chute, or passage way, into a vat across which they are made to swim, and which contains a liquid that kills the parasites. A similar model represented a dipping plant for the treatment of mange, or scabies, in cattle, the diseases in cattle and sheep being of a similar nature and caused by related parasites.

These two diseases have been quite prevalent in the West and have caused great damage to the sheep and cattle interests. Within the last few years, however, the Bureau, with the cooperation of some of the State authorities, has succeeded in completely eradicating sheep scab from large portions of the territory formerly infected; and, while the work with regard to cattle mange was not begun so early, good headway has also been made against that disease. It is hoped that in the course of a few years the country will be freed from both diseases.

The Bureau's plan of work, in brief, is to inspect the animals on the ranges, at shipping points, and at the stock yards, and to require the dipping of all that are found diseased or to have been exposed. The extent of this work is shown by the fact that during the fiscal year 1904 there were 40,967,961 inspections and 9,578,476 dippings of sheep and 1,124,321 inspections and 157,757 dippings of cattle, some of the animals being subjected to more than one inspection and dipping.

TEXAS, OR SOUTHERN, CATTLE FEVER.

One of the notable scientific achievements of the Bureau was the discovery of how this disease is caused by a microorganism which is transmitted from one animal to another through two generations of the cattle tick. This discovery not only cleared up the mystery surrounding Texas fever and made it possible to adopt measures to control the disease and prevent the spread of the infection beyond the territory which constituted the natural habitat of the tick, but it established a new principle in medical science, which has since been found to apply to the transmission of malaria, yellow fever, and other diseases.

In the exhibit the hide of a calf with wax models of ticks thereon illustrated the appearance of an animal infested with the contagion-carrying parasites. Lesions of the disease were shown by models of the spleen and liver of an affected animal, and models of these organs from a healthy animal were also shown for comparison. The section of the country infected with this disease was outlined on the large wall map of the United States. The Bureau has devised and main-

tains a system of quarantine supervision by which cattle from this section are shipped to market in the noninfected district practically without danger to other cattle.

BLACKLEG.

Preventive vaccination seems to be the only practicable way of controlling this disease, which is very fatal to young cattle, and for several years the Bureau has distributed to stock owners a reliable vaccine. The steps in the preparation of this vaccine were shown by specimens of material in the various stages, from the dried muscle of a diseased animal to the powdered vaccine put up in packets ready to be sent out. From 1,000,000 to 2,000,000 doses of this vaccine are sent out annually by the Bureau, and returns for the last year show that only 0.44 per cent of the vaccinated animals died from blackleg, while the usual loss in affected sections among animals not vaccinated is about 10 per cent of the calves produced annually.

A model of a vaccinating and dehorning chute, showing a good method of holding calves for the purpose of vaccinating and dehorning them, was an object of interest to practical stockmen.

FOOT-AND-MOUTH DISEASE.

The exhibits relating to this disease attracted attention among veterinarians and stockmen because of the recent severe outbreak in New England and because very few of these visitors had ever had an opportunity of observing the disease. There were pathological specimens and illustrations showing the lesions of the disease, and a large map with sections colored to show the territory over which it spread.

The work of the Bureau in eradicating this outbreak in a vigorous campaign of a few months, with the assistance of the State authorities, may be appreciated when it is known that other countries have struggled in vain with the disease for decades. In stamping out the disease the Bureau slaughtered and paid for 4,461 animals, mostly cattle and sheep, and expended in all a quarter of a million dollars. The expense, however, was infinitesimal compared with the loss which the country would have sustained if the contagion had been allowed to remain and spread.

SCIENTIFIC EXHIBITS.

The scientific work of the Bureau in investigating the causes, nature, prevention, and cure of animal diseases was well represented by the exhibits from the laboratories.

An extensive collection of specimens and pictures illustrated the characteristic appearances of various diseases and some of the para-

sites which affect animals. Many of these specimens were found in the course of the meat inspection, and served to show in a forcible manner some of the dangerous and unwholesome conditions which the Bureau removes from the public food supply. Others represented the scientific investigations with reference to tuberculosis, hog cholera, and other diseases, some of which have a bearing on human medicine. The specimens, preserved in alcohol, were displayed in glass jars in two cases, one containing 80 pathological subjects and the other a like number of parasitic specimens. Those showing the lesions of tuberculosis produced experimentally in animals by inoculation with germs taken from human subjects and by means of the milk of tubercular cows attracted much attention from medical men. The parasitic specimens included ticks, roundworms, tapeworms, and flukes, several of these parasites being communicable to man. Many of the species were shown at different stages of their life cycles.

Rinderpest, a contagious and highly fatal disease of bovine animals, which fortunately has been kept out of this country, was illustrated by plaster models.

Twenty water-color paintings illustrated in natural colors the diseased conditions found in postmortem examinations. A case of 60 transparent photographs showed a variety of subjects, including the carcasses, tissues, and organs of animals affected with various diseases, magnifications of slide preparations of pathogenic microorganisms, and enlarged views of animal parasites.

In a case were displayed cultures of various pathogenic bacteria, also bacterial products, such as tuberculin, mallein, antitubercle serum, tetanus toxin and antitoxin, hog-cholera toxin and serum, diphtheria and swine-plague toxin, and some of the substances obtained on analyzing tubercle bacilli.

A model laboratory, equipped with apparatus used in making investigations in pathology, bacteriology, and zoology, formed part of the exhibit.

An outfit for the treatment of milk fever in cows by means of sterilized air was shown. This simple method, recently discovered, has proved wonderfully successful in the cure of this disease.

HORSESHOEING AND THE ANATOMY AND DISEASES OF THE HORSE'S LEG AND FOOT.

An exhibit showing the most approved and scientific methods and appliances for shoeing horses illustrated the great improvement that has been made over the crude methods formerly used. An extensive collection of hoofs showed normal feet of different sizes and shapes and various deformities and abnormal conditions resulting from disease and improper shoeing. There was also a display of horseshoes

of various sizes and shapes for normal feet and for correcting abnormal conditions. Many instruments used in shoeing and various kinds of horseshoe nails were also shown.

Along with this exhibit was a large display of models and specimens illustrating the anatomy of the horse's leg and foot and the common diseases affecting the joints, bones, and tendons, such as spavin, splint, ringbone, and laminitis.

DAIRY EXHIBIT.

The dairy display was quite extensive and covered nearly every conceivable phase of the industry. The main idea in its preparation was to make it as practical as possible. It illustrated the most modern and improved methods and appliances, and formed an interesting and instructive object lesson for dairymen and other visitors who were in any way concerned in the dairy industry.

What was termed a "clean milk exhibit," occupying a large wall case, was one of the most attractive and practical features. It comprised every utensil needed in a 10-cow dairy for the production of sanitary milk. There were exhibited a modern separator, cooler, bottler, sterilizer, milk tester, milk scales, and bottle washer; also cans, pails, bottles, caps, delivery baskets and cases, shipping cases, dairy suits, scrub brushes, cattle cards, etc. Two wax figures of men in spotless linen suits, with pails and stools in hand ready for work, were prominent in this exhibit.

A miniature model of a 20-cow dairy showed the proper construction and arrangement of a sanitary stable, with modern stalls, ties, watering devices, and feeding arrangements, and with provision for light and ventilation. This model was prepared with much care, every part being built to an exact scale. Models of cows occupied some of the stalls.

A full-sized iron cow stall of modern type and practical construction was shown, also two small models of silos, and a half-size model of a retail milk-delivery wagon.

Considerable space was given to a collection of appliances used in various parts of the world in connection with the dairy business. This exhibit included many different styles of cans, jars, and bottles, and commercial butter and cheese packages. Many of these articles came from England, Switzerland, Belgium, Holland, and other old dairy countries. Among the curiosities were an immense cow bell, said to be more than a century old, from Switzerland, and an English yoke, with two pails, for carrying over a person's shoulders.

The work of the Bureau in the inspection and certification of dairy products for export, and in the supervision of the manufacture of renovated or process butter, was illustrated by specimens of the labels

and certificates used and by sample packages of the products. The Bureau inspects dairy products intended for export and certifies to their character and quality. Under a recent act of Congress it also conducts a sanitary inspection of the renovated butter factories, the materials used, and the product turned out. Each package of this product must be plainly marked so that it may be identified in the market as renovated butter. This butter is considered wholesome when properly prepared, and is sold at a lower price than the regular creamery article. In the fiscal year 1904 the inspection covered 72 factories with a production of over 54,000,000 pounds.

The great extent of the condensed-milk industry was shown by a display of about 300 cans representing brands manufactured in the United States. The processes of manufacture were illustrated by models of milk-condensing machinery and by large photographs. The proportions of the component parts of condensed milk were shown by means of various colors in a tall glass cylinder. The actual ingredients of a 10-pound can were also shown in glass jars. A large chart showed the increasing volume of the output and exports of this product.

Models of 34 varieties of foreign cheese, embracing a great variety of forms and sizes, attracted much attention. Samples of milk products, such as casein, milk sugar (powdered and in crystals), dried milk and cream, and beverages, were exhibited. The composition of milk, cream, butter, and cheese was illustrated by means of colored layers in glass jars, and the actual constituents of 10 pounds of each of these products were also shown. Among other exhibits were samples of lactic-acid ferments for preparing "starters" and ripening cream; appliances and systems for salting and coloring butter; apparatus for testing milk and butter, and pots and forms used in the manufacture of cheese.

A novel and interesting feature of the dairy exhibit was a display of articles made in Germany from dried casein of milk. The material is known as galalith, milk-stone, or petrified milk. In appearance it resembles celluloid, ivory, onyx, and hard rubber, and it may be used as a substitute for those substances in the manufacture of many articles in everyday use. It can be made in any color and takes a high polish. Among the articles exhibited were combs, brushes, buttons, penholders, billiard balls, dominoes, chess figures, and handles for umbrellas, canes, knives, and razors.

The walls adjoining the dairy exhibit were covered with charts and maps showing the extent of the dairy industry according to the latest census. This part of the exhibit gave a good idea of the magnitude and rapid development of the dairy industry in this country.

ANIMAL HUSBANDRY.

Live animals, of course, were not shown in the Bureau space, but were exhibited in the live-stock section of the exposition. The paintings in the frieze and other pictures in the Bureau exhibit, however, served to illustrate the best types of the principal species of farm animals. The paintings were made from photographs of selected representative animals. Cattle of the best beef and dairy types, different breeds of horses, sheep and hogs, and mules and Angora goats were shown in the pictures.

MOVING PICTURES.

The panorama of moving pictures proved to be a popular and highly entertaining feature of the Bureau's exhibit, and when in operation it always drew a crowd of spectators. There were 14 large paintings in oil colors, picturing some of the work done in the different branches of the Bureau service and some dairy scenes. The subjects illustrated were the postmortem inspection of cattle in an abattoir, the taking of samples for the microscopic inspection of pork, the inspection and tagging of cattle in stock yards previous to exportation, the loading of horses and cattle on ships, the decks of steamers with fittings in accordance with the Bureau regulations for the safe transportation of live stock, views on the decks of vessels loaded with cattle and horses, and scenes in a model dairy stable.

PUBLICATIONS.

A set of 30 bound volumes in a case represented the literature issued by the Bureau in the twenty years of its existence. These publications are issued for the benefit of the public and most of them are for free distribution. They treat a wide range of subjects in both a popular and a scientific manner.

ATTENDANCE AND RESULTS.

More than a million and a quarter of people visited the exhibit of the Bureau, according to calculations carefully made by an attendant who was present throughout the exposition period. On some days the attendance approximated ten thousand.

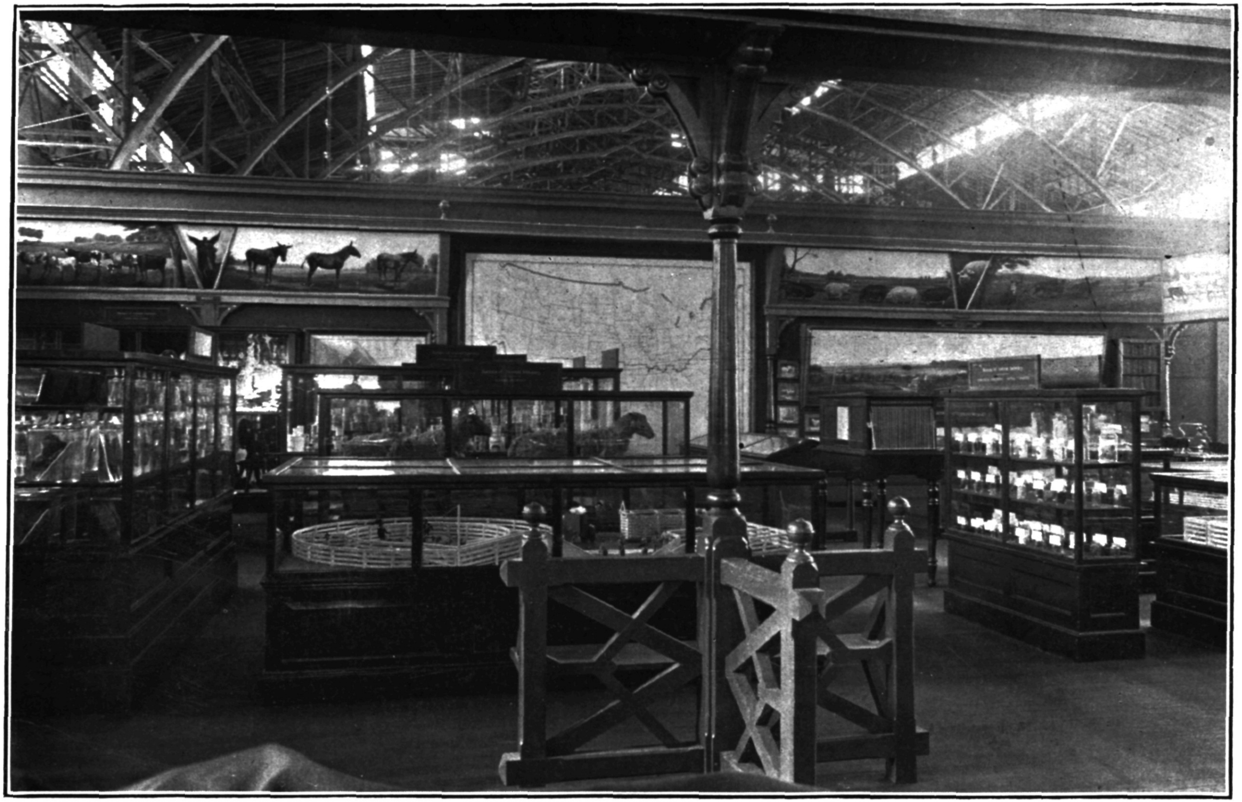
There was a considerable proportion of farmers, dairymen, and stock raisers, and quite a number of veterinarians, physicians, and scientists, all of whom from the nature of their occupations were especially interested in some phase of the exhibit. But most numerous of all was the great American public, interested in seeing the sights of the exposition and especially the Government display. Scientific

gentlemen from England, Germany, Austria, Japan, Mexico, Cuba, Hawaii, Russia, Brazil, and India were among those who called at the exhibit and showed an interest in learning of the work of the Bureau. Numerous requests for information and literature were complied with so far as possible.

The structure surrounding the exhibit was provided with seats, which afforded grateful resting places for weary visitors. The microscopic demonstrations and the moving pictures supplied the elements of life and motion which are so much more attractive to the ordinary visitor than a still display.

The great practical and educational value of the exhibit can not be questioned. Thousands of farmers and stock raisers and dairymen received information and ideas which will undoubtedly enable them to conduct their several lines of business to better advantage. Veterinarians, physicians, scientists, and students found instructive material in the scientific parts of the exhibit. The general public learned how to recognize inspected meats in the markets. Foreigners saw the measures which are taken to insure the wholesomeness of American live stock, meats, and dairy products exported for their consumption. And the people who came without any adequate conception of the work that is being done by the Bureau in the interest of the live-stock industry, the public health, and the commerce of the United States went away impressed with the value and importance of this service, which yields to the people a thousandfold what it costs.

A GENERAL VIEW OF THE BUREAU OF ANIMAL INDUSTRY EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION.



A VIEW OF PART OF THE EXHIBIT SHOWN ON PLATE 46.

Photograph by Dr. J. William Fink.

MISCELLANEOUS INFORMATION.

The horse of Abyssinia.—Hon. Robert P. Skinner, United States commissioner, Marseille, France, in the course of a lengthy article on Abyssinia, says this about the horse of that country:

The Abyssinian horse is small but resistant. He attains ordinarily a height of 4 feet 8 inches, and is usually employed as a mount. The best breeds come from the plains between Ankobar and the south of the Blue Nile. The Emperor is in possession of a large number of very beautiful animals. Abyssinian horses are sold in Madagascar, Reunion, Mauritius, and the Transvaal. The price of an ordinary animal varies from $4.82 to $11.58, the highest prices being obtained near the coast. Exceptionally fine horses bring from $38.60 to $115.80.

Government aid to horse breeding in Italy.—In the course of an article on the general subject of Government aid to industries in Italy, Das Handels-Museum, a prominent commercial paper of Vienna, Austria, makes the subjoined comments on Government aid to horse breeding:

Horse breeding in Italy is not carried far enough to supply the annual demand of the country. This amounts to fully 80,000 head, and the supply is only 30,000. To cover this deficiency $5,790,000 are paid to foreign parts for horses. Twenty thousand ponies are imported annually from Dalmatia and the neighboring territory. Ligurian horse breeders claim that this is an injury to the production of horses in Italy, " for," say they, " the sharp competition results in driving out Italian competitors; besides, the reputed inferior quality in the imported horses discourages Italian breeders in their efforts to improve the quality of Italian horses." An act presented by the Government in June, 1904, looking to the improvement of horses, has been received with gratitude and joy by the breeders. In order to bring the number of the stallions owned by the State up to 800, as provided for in the law of 1887, and to encourage horse breeders to use the finest stallions and mares for the purposes of breeding, $96,500 were provided for in the budget to be used during 1904–5. This sum is to be employed as follows: $44,390 for the purchase of young breeding stallions, $19,300 for prizes for mares used in breeding, $14,475 for subsidies for organizations of breeders and for supplying stallions and mares at cheaper rates to unions and private parties, $6,755 for foals, $47,720 for veterinary surgeons, and $3,860 for transportation, saddles, medicine, etc. The division of the subsidies in the following years will be made after preliminary consultation with the council of State officials charged with the matter of horse breeding. The number of members in this council will be increased, according to the law of 1887, to 9, of whom 6 must be horse breeders. In accordance with a royal decree, a breeding place may be established in the royal forests of Sardinia.

In discussing the act connected with the breeding of horses, attention has been directed to the importance of laying duties on imported horses, the more particularly as Italy is just now discussing the question of trade treaties.

It is argued that Italy should do as France did before 1897 and as the United States is doing at present—that is, tax in the inverse ratio of size and value of the animals. In this way those coming from Dalmatia, which now have the largest influence on the market, will have to pay the highest duty. It was made evident that in this way a certain good would be done and that increased prices would result which would benefit the agricultural sections of Italy that now stand very much in need of horses.

German imports of horses.—Consul Brainard H. Warner, jr., at Leipzig, Germany, reports that Germany imports more horses and exports fewer horses than any other country. He states that good draft, carriage, and saddle horses are always in demand, and that the best of these are always imported. The following table shows the number and value of the horses imported by Germany for the three years of 1899, 1901, 1902, and also the country from which imported.

Number and value of horses imported by Germany, 1899, 1901, and 1902.

Whence imported.	1899.		1901.		1902.	
	Number.	Value.	Number.	Value.	Number.	Value.
Belgium	22,576	$4,822,832	17,987	$5,615,372	20,963	$6,887,958
Denmark	19,929	4,031,720	17,397	3,595,228	21,691	4,962,300
Russia	36,234	4,311,846	33,885	3,152,072	35,131	3,260,600
Austria-Hungary	16,188	2,889,558	12,948	2,023,238	14,485	2,174,606
Netherlands	8,854	1,580,558	8,032	1,458,940	10,785	2,112,250
France	7,054	1,594,838	6,932	1,869,490	6,213	1,809,038
Great Britain	2,210	894,166	1,328	474,810	1,020	375,564
Switzerland	868	123,998	830	151,844	840	174,454
United States	4,343	682,380	553	86,900	137	16,475
All other	600	200,362	429	286,760	402	223,905
Total	118,796	21,132,258	100,321	18,714,654	111,667	21,997,150

The cattle industry of Brazil.—The following observations are from Export, a German commercial paper:

The cattle industry is the most important one in this State. Besides inland consumption, about 400,000 cattle are used for jerked beef. The largest part of the beef is sent to Rio de Janeiro, Bahia, and Pernambuco, where 18 pounds of the product is worth from $1.43 to $2.86. Two hundred and twenty pounds of fresh beef will give 110 to 120 pounds of jerked beef. A steer weighing 300 pounds, without bones, is worth $11.90; a fat cow, about $9.50; a sheep, from 70 cents to $1.90, and 2.2 pounds of fresh beef, 4.7 to 7.1 cents. The jerked beef is here worth double the above price. In the cities of Rio Grande do Sul 2.2 pounds of jerked beef are worth from 7.1 to 9.4 cents.

Jerked beef is prepared in a primitive way, which not only causes a loss of taste but of the nutritive value. It is therefore an unsatisfactory method of preserving meat.

In Rio de Janeiro 2.2 pounds of fresh beef cost from 23.8 to 28.5 cents, and in Manaos 47.6 to 59.5 cents.

The exports of live cattle from Rio Grande do Sul are also increasing, but not as they would if transportation facilities were better. Any undertaking which would result in exporting beef in a better form than that of jerked beef would be exceedingly profitable and would make the jerked-beef industry almost

impossible. Although the climate is more unfavorable than at Chicago, there are a number of methods used there which could be employed here, and, in addition, cattle are cheaper here.

The live-stock industry in Japan.—Hon. E. C. Bellows, consul-general at Yokohama, furnishes the Consular Report for August, 1904, some interesting facts about the agriculture of Japan. The following extracts relate to the animal industry:

Stock raising is still in its infancy in Japan and is not likely to become an important industry owing to the high price of land and the coarseness of the native grasses, most of which are not fit for food for cattle or horses. Oats and maize as foods for farm animals are practically unknown, and what passes for hay is a kind of straw, which is chopped fine before it is fed to horses. A little less than one-sixth of the arable land consists of plains and pastures, and of this about two-fifths belong to the State and the imperial household, the remainder being owned by private stock raisers, who raise stock principally for tillage and draft animals. The natives are not accustomed to the use of butter or milk and do not usually like the taste of them, and their religious prejudices have hitherto prevented the general use of meat of any kind, although they now seem to be developing a taste for all these kinds of foods.

Farmers do not engage in poultry raising to a sufficient extent to provide the eggs needed for home consumption, these being imported from China to the value of over $500,000 per year.

Efforts have been made to introduce sheep raising and swine raising, but with only partial success. It is claimed that the conditions of climate and food supply present no serious obstacles to the success of sheep farming, but the statistics of 1901 showed only 2,545 sheep in the country. Swine raising has succeeded better, but can not yet be spoken of as an established industry of much importance, the number of swine having remained in the vicinity of 200,000 for several years.

The Government carries on an experimental farm, and there is connected with it a laboratory for investigating the diseases of cattle and poultry; also a cattle-breeding pasture for improving the native breeds of cattle for meat and dairy purposes, and two horse-breeding pastures for promoting the introduction of better horses.

Live stock in Mexico.—Hon. James A. Le Roy, consul at Durango, gives in the following table the number of live stock in the State of Durango and also for the entire Republic:

Number and value of live stock in the State of Durango and total number and value of live stock in Mexico in 1903.

Kind.	Durango.		Mexico.	
	Number.	Value.	Number.	Value.
Cattle	233,041	$1,767,509.02	5,304,065	$38,587,009.75
Horses	104,674	449,580.59	872,544	5,082,731.50
Mules	32,931	365,562.96	340,016	4,920,054.92
Goats	534,304	439,031.93	4,258,870	3,336,623.89
Sheep	383,947	295,945.85	3,458,134	2,792,008.30
Donkeys	28,109	123,674.65	298,516	1,131,260.00
Hogs	21,684	28,010.36	640,074	1,005,061.30

This gives an average value, in United States currency, per head, for the country at large, as follows: Mules, $14.47; cattle, $7.27; horses, $5.83; donkeys, $3.80; hogs, $1.57; sheep, 80 cents; goats, 78 cents. In some districts in particular, and elsewhere on the part of certain individuals, there have been efforts in recent years to improve the stock, especially of horses and cattle, by importations from the United States and Europe. This effort at "breeding up" has already resulted in marked improvement in places. Speaking of the country in general, however, only a beginning has been made in this direction.

Venezuelan cattle for Cuba.—During the month of August, 1904, according to Norman Hutchinson, secretary of legation, there were shipped from Puerto Cabello, Venezuela, on 14 steamers, 13,631 head of cattle, all destined for Cuban ports. This total is 1,806 greater than the shipments from the same port to Cuba in August of 1903. If August is a fair average, the total shipments in 1904 would equal 163,572.

Number of cattle in Australasia.—The following table gives the number of cattle in Australasia for the years 1881, 1891, 1901, and 1902:

Colony.	1881.	1891.	1901.	1902.
	Number.	*Number.*	*Number.*	*Number.*
New South Wales	2,597,348	2,046,454	2,047,454	1,741,226
Victoria	1,286,677	1,812,104	1,602,384	1,602,384
Queensland	3,618,513	6,192,759	3,772,707	2,543,471
South Australia	314,918	676,933	479,863	519,163
West Australia	63,009	133,690	394,580	437,588
Tasmania	130,526	167,666	168,661	178,385
New Zealand	698,637	831,831	1,361,784	1,460,663
Australasia	8,709,628	11,861,437	9,827,433	8,482,880

Number of sheep and cattle in Buenos Ayres.—The following table gives the number of sheep and cattle in Buenos Ayres for a series of years:

Year.	Sheep.	Cattle.	Year.	Sheep.	Cattle.
	Number.	*Number.*		*Number.*	*Number.*
1881	57,838,073	4,439,953	1901	60,090,000	9,588,000
1888	51,238,782	8,343,266	1902	65,783,000	9,805,600
1895	52,630,451	7,745,896	1903	69,230,000	10,165,000
1900	64,000,000	9,500,000	1904	75,836,000	10,277,313

Importation of cattle into the Transvaal.—During the year 1903 the colonial government of the Transvaal imported cattle for the purpose of stocking the various government farms as follows, as reported by Hon. Joseph E. Proffit, consul at Pretoria, South Africa:

From—

Somaliland	995
Queensland	300
United States (Texas)	10,000
Madagascar	20,000
Great Britain	200
Total	31,495

From March to May, 1904, the number of 11,206 head were imported from Texas by private parties. Of this number 154 died from accident on shipboard.

American cattle and mules in northern Brazil.—The report comes from Hon. K. K. Kenneday, consul at Para, Brazil, that large cattle steamers from the United States arrive there loaded with fine breeding cattle and mules. The consul says the natural conditions of the upper Amazon country are very favorable to cattle raising, and these imported cattle are for the purpose of improving the native stock.

Russian association for breeding hogs and cattle.—It is stated by Hon. R. T. Greener, commercial agent at Vladivostock, Siberia, under date of November 13, 1903, that a Russian association for breeding hogs and cattle was started near Harbin, in 1902. The object is to raise cattle of good breeding and Yorkshire hogs. They had 900 head of the latter on hand in 1903, and the purpose was to increase the number to 7,000. It is proposed to manufacture smoked hams and dry sausages.

The frozen-meat trade with Great Britain.—The following details of this trade are obtained from a circular issued by the Colonial Consignment and Distributing Company, with headquarters in London, England, which operates very largely in frozen meat from the Australasian colonies.

MUTTON AND LAMB.

Imports of frozen sheep and lambs into Great Britain, 1903 and 1904.

Country of origin.	Sheep.			Lambs.		
	1903.	1904.	Increase (+) or decrease (−).	1903.	1904.	Increase (+) or decrease (−).
	Carcasses.	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*
New Zealand	2,424,009	1,970,373	−453,636	2,160,763	1,913,215	−247,548
Australia	214,064	122,158	− 91,906	264,177	328,690	+ 64,513
River Plate	2,943,990	2,730,796	−213,194	174,498	207,431	+ 32,933
Total	5,582,063	4,823,327	−758,736	2,599,438	2,449,336	−150,102

The table shows the largest contributor of mutton alone to be the River Plate region (Argentina), but taking sheep and lambs together it will be seen New Zealand takes the lead by nearly a million carcasses. The receipts of mutton and lamb from New Zealand give a total, in 1904, of 3,883,588 carcasses, as against 4,584,772 carcasses in 1903. The decline, although considerable, furnishes no surprise when the extent of the flocks in this colony are taken account of. The approximate stocks in the colony on April 30, 1904 (the end of the summer in that part of the world), totaled 18,280,806. This number is close upon 1,000,000 less than the estimate for 1903. The exports from the colony during 1904 represent 21 per cent of the total stocks for that year. The percentage of 1903 was 24, while that of 1902 was 18. The increased killings in 1903 were the cause of the depletion in the flocks of 1904, as compared with the year named; the ratio of last year—21 per cent—is considered as high as can safely be maintained for the present.

Monthly arrivals of frozen mutton and lamb in Great Britain, 1904.

Month.	Sheep.				Lambs.			
	New Zealand.	Australia.	River Plate.	Total.	New Zealand.	Australia.	River Plate.	Total.
1904.	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*	*Carcasses.*
January	157,906	4,540	140,520	302,966	15,626	112,758	30,990	159,374
February	78,200	782	149,459	228,441	60,626	48,038	34,571	143,235
March	119,452	1,750	246,487	367,689	181,037	15,580	26,890	223,507
April	322,384		310,544	632,928	455,548	1,800	32,086	489,434
May	142,676		200,835	343,511	200,931	1,286	19,723	221,940
June	287,093		255,786	542,879	400,696		18,962	419,658
July	198,022		237,303	435,325	231,937		12,056	243,993
August	155,430		320,476	475,906	138,179	529	14,222	152,930
September	250,501	7,738	122,291	380,530	171,620	1,100	1,143	173,863
October	89,018	9,515	255,885	354,418	34,295	12,539	3,792	50,626
November	109,217	41,528	268,614	419,359	17,795	15,157	2,051	35,003
December	60,474	56,305	222,596	339,375	4,925	119,903	10,945	135,773
Total	1,970,373	122,158	2,730,796	4,823,327	1,913,215	328,690	207,431	2,449,336

The import trade into Great Britain of frozen carcasses of sheep and lambs commenced in 1880 with a small consignment from Australia, and during the next year the trade became firmly established by increased consignments from this colony. The following year (1882) witnessed the first arrivals from New Zealand, and in 1883 the River Plate region entered into the competition. New Zealand at once assumed the lead in the magnitude of the consignments and has kept it to the present day, although the River Plate has at times been a close second. The 1,000,000 carcass mark was first reached by New Zealand in 1889, the River Plate arriving at this mark the following year. The full consignments for the last-named year (1890) were as follows: New Zealand, 1,532,833 carcasses; River

Plate, 1,198,731 carcasses; Australia, 208,294 carcasses. The trade has been steadily increasing year by year until 1903, when the total receipts were: New Zealand, 4,584,772 carcasses; River Plate, 3,118,-488 carcasses; Australia, 478,241 carcasses.

The high-water mark of the Australian consignments was reached in 1896, when 1,651,245 carcasses were placed on the market. Since then the prolonged drought in that colony has played havoc with the flocks, and the result has been a steady decrease in the shipments. The past two years' totals were each below half a million, but the present conditions tend toward an increase.

The United States has little or no part in this trade, supplies from this country only coming forward when prices are unusually high.

Continental Europe furnishes a few carcasses, the principal purveyor being Holland and the only other European source of supply mentioned being Servia.

The yearly receipts from the Australasian colonies and the River Plate, covering the entire period of the trade, are shown in the following table:

Annual imports of frozen carcasses (sheep and lambs) from New Zealand, Australia, and River Plate, 1880 to 1904.

Year.	New Zealand.	Australia.	River Plate.	Year.	New Zealand.	Australia.	River Plate.
1880		400		1893	1,894,751	640,088	1,356,389
1881		17,225		1894	1,958,923	927,739	1,366,457
1882	8,839	57,256		1895	2,441,057	982,290	1,652,625
1883	120,893	63,733	17,165	1896	2,212,258	1,651,245	1,798,882
1884	412,349	111,745	108,823	1897	2,702,456	1,397,578	2,122,999
1885	492,269	95,051	190,571	1898	2,784,122	1,226,352	2,400,640
1886	655,888	66,960	434,699	1899	3,249,857	1,227,152	2,411,519
1887	766,661	88,824	641,866	1900	3,154,799	943,668	2,331,588
1888	939,915	112,214	908,689	1901	3,234,622	1,226,300	2,632,716
1889	1,080,564	95,920	966,495	1902	3,667,101	722,323	2,827,439
1890	1,532,833	208,294	1,198,731	1903	4,584,772	478,241	3,118,488
1891	1,906,002	335,192	1,127,753	1904	3,883,588	450,848	2,938,227
1892	1,535,683	505,927	1,248,295				

PRICES OF MUTTON AND LAMB.

The heavy supplies of 1903 caused low quotations to rule at the close of that year, but the market conditions at the commencement of 1904 were favorable to an advance. This expectation was duly realized, and after a slight rise in all grades at the beginning of the year values remained very steady for several months; there was an almost imperceptible sagging in the first part of November, and from then on to the end of the year a decidedly sharp rise.

The various grades of mutton and lamb are rated on the English markets as follows: (1) New Zealand lamb (all classes), (2) Australian lamb (all classes), (3) Canterbury (N. Z.) sheep (prime

wethers and maiden ewes), (4) Southland (N. Z.) sheep (all classes), (5) North Island (N. Z.) sheep (all classes), (6) River Plate sheep (all classes), (7) Australian sheep (all classes).

The following table shows the range of prices per pound of the various classes during the year for quarterly periods:

Range of prices per pound on English markets of frozen mutton and lamb for quarterly periods of 1904.

Grade.	January to March.	April to June.	July to September.	October to December.
	Cents.	*Cents.*	*Cents.*	*Cents.*
New Zealand lamb (all classes)	9¼–12	10 –11¼	11¼–11½	10¾–13
Australian lamb (all classes)	8¾– 9¾	8¾– 9½	(a)	9¾–12¼
New Zealand:				
Canterbury sheep (prime wethers)	8¾– 9¼	9¼– 9½	9 – 9¼	9 –10
Southland sheep (all classes)	8¼– 8¾	8¼– 8½	8¼	8¼– 9½
North Island sheep (all classes)	7¾– 8¼	8	7¾	7¾– 9
River Plate sheep (all classes)	6½– 8	8	8	7½– 8½
Australian sheep (all classes)	7¼– 7½	(a)	(a)	7 – 7¾

[a] No consignments.

As before intimated, the range of prices for the past year showed a substantial advance on those of 1903. The average prices of New Zealand mutton for the two years, in comparative form, were as follows:

Average annual prices realized for New Zealand mutton.

[Average price per pound.]

Grade.	1903.	1904.
	Cents.	*Cents.*
Canterbury (prime wethers)	8.82	9.24
Southland (all classes)	7.90	8.52
North Islands (all classes)	7.64	8.04

BEEF.

Frozen beef for the British market is attributed to three sources—River Plate, New Zealand, and Australia. Fully four-fifths of this product comes from the first-named region, as may be seen by the following statement:

Imports of frozen beef, January 1 to December 31, 1903 and 1904.

	New Zealand.	Australia.	River Plate.	Total.
1903, quarters and pieces	92,092	45,587	565,869	703,548
1904, quarters and pieces	106,829	46,354	789,487	942,670
Increase	14,737	767	223,618	239,122

It will be seen the importations from the River Plate show a very large increase, compared with 1903. This rapid development is in great measure caused by the stoppage of the live-cattle trade with Argentina. The latter country is becoming more and more of a beef-producing country, and since it can not send out its surplus in the shape of live cattle the only alternative is to do the slaughtering at home and export the animals in another form.

PRICES OF FROZEN BEEF.

There was a striking lack of correlation between the prices of frozen mutton and frozen beef during 1904. The former remained practically on a level (if anything, a slightly downward tendency) during the summer months; beef, on the other hand, went up by leaps and bounds from the middle of May to the middle of July. The principal cause of this was the meat strike in Chicago, and a contributory cause was a slight disturbance of the same nature in the South American meat trade. After these matters were settled values gradually sagged until they reached a lower point than they were previous to the rise. After this prices continued to rule low, and it is evident the British market is well supplied with this product.

For the first four months of the year prices of River Plate frozen beef fluctuated from $5\frac{1}{2}$ to $6\frac{1}{2}$ cents per pound for hind quarters, and from $4\frac{1}{2}$ to $5\frac{1}{2}$ cents for fore quarters; these being Smithfield (London) quotations, prices in the provincial towns would frequently be a trifle higher. Toward the end of May the high price of United States chilled beef influenced the market to the extent that hinds advanced to 7 cents, although fores remained stationary at about $4\frac{1}{2}$ cents. The Chicago strike at the end of July was the next factor in the situation. Values now jumped to $10\frac{1}{2}$ to 11 cents hinds and $6\frac{1}{2}$ cents fores, and heavy stocks were disposed of at these good figures. After the market became normal again a steady decline followed, until the lowest point for the year was reached in November, top values of hinds being $5\frac{1}{4}$ cents and fores $4\frac{1}{4}$ cents. Prices stiffened a little toward the end of the year, which closed with hinds quoted at $6\frac{1}{2}$ to 7 cents and fores $5\frac{1}{2}$ to 6 cents.

American meat a necessity in Germany.—The appended paragraph from a recent annual report of the Chamber of Commerce of Berlin is significant regarding the condition of the masses in Germany:

Nothing can take the place of American bacon as a cheap and nutritious article of food for the masses of our population. Therefore it would be a matter of deep regret if the high import duties of the new tariff law were not reduced to a reasonable degree. The year 1903 will test the ability of German

meat packers to supply the country with canned beef, which formerly was supplied by the United States and Australia, excellent in quality and cheap in price. Hitherto German canned beef has not come up to the foreign product in quality and appearance; whether it will improve in these respects remains to be seen. However this may be, there is just cause for feeling that German canned meat will be so high in price as to fail of becoming a popular food; consequently the injury which will be caused by the new laws will be obviated if foreign canned meat is again allowed to come into Germany.

Germany's attempt to produce canned meat.—The Vossische Zeitung of March 2, 1904, makes the following statement with reference to Germany's prohibition of American and Australian canned meats:

The German attempt to produce canned meat equal in quality to the American and Australian product has achieved no definite success. In the yearly report of the Berlin Chamber of Commerce we read on this subject.

"Ox tongues were turned out of good quality, but were too costly. German canned meat can not be for Germany what the 'corned beef' was—a good and cheap food material for the people. A fundamental reason why it has not been and can not be possible to produce an equally good and cheap product is the lack of the indispensable cheap beef. It was a great mistake in our economic policy to prevent the importation of the American and Australian canned meats. Sanitary objections do not exist, and our agriculturists derive no advantage from the prohibition; but, on the other hand, the laborer is deprived of a cheap and nutritious food product."

American meats in France.—Under this head, Hon. John C. Covert, consul at Lyon, France, writes the following, dated September 25, 1904:

The American packed meats that come to France have almost made a revolution in the dietary habits of the French people. Within the memory of many now living the working people of France could enjoy meat but two or three times a year, and then only on some great occasion, such as a wedding or important anniversary. At present it may be said that there is hardly a man in the country who can not have a piece of meat once or twice a day, and this amelioration of the condition of the people is very largely due to the packed, dried, and salted meats from the United States.

Spain's imports and exports of animal products.—Hon. Julius G. Lay, consul-general at Barcelona, Spain, states that in 1903 Spain exported hides to the value of $4,000,000, cattle $4,000,000, and wool $2,000,000; and during the same year exported $3,750,000 worth of live stock, $2,800,000 of hides and skins, and $1,700,000 of wool.

Prussia to make sausage.—The statement is made by S. P. Warner, consular agent at Gera, Germany, that the Prussian war department has decided to establish a sausage factory at Spandau, an important Prussian fortress near Berlin, in order to supply the gar-

risons at Spandau and Doeberitz. The factory will be in charge of the commissary office, which is contemplating the establishment of such factories wherever there are located large bodies of troops. The reason given for this action is that this procedure will insure the use of the best meat only, and it will therefore be one way of insuring the best possible physical condition of the soldiers.

Argentine meat in Belgium.—In the spring of 1904, according to Hon. George W. Roosevelt, consul at Brussels, Belgium, a large importation of beef and mutton in cold storage was made from La Plata and was opened up for sale in the shops of several cities. This meat was retailed at prices varying from 7 to 14 cents per pound, or nearly 4½ cents per pound less than native beef and mutton. The meat is said to be of excellent quality, and the unexpected competition has created considerable uneasiness among the butchers. The meat is sent direct from Argentina to Antwerp.

Exports of Argentine animals and animal products.—The following table is from a report of D. Mayer, consul-general at Buenos Ayres:

Exports from Argentina, by articles and quantities, for the first six months of 1904.

Live cattle, number	50,235	Butter, tons	3,182
Live horses, do	19,679	Tallow, do	17,945
Live sheep, do	19,993	Bones, do	9,244
Frozen meat, tons	39,073	Linseed, do	699,233
Frozen mutton, do	46,359	Maize, do	611,673
Hair, do	832	Hay, do	24,047
Goat and kid skins, pounds	1,913,810	Wheat, do	1,591,930
Sheepskins, tons	16,041	Sugar, do	6,816
Ox and cow hides:		Wheat flour, do	47,667
Dry, do	9,096	Bran, do	63,810
Salted, do	15,151	Extract of quebracho, do	5,919
Horsehides, dry and salted, pounds	3,893,400	Quebracho wood, do	117,065
Wool, tons	121,849	Nutria skins (beaver), pounds	182,930
Tasajo (jerked beef), do	3,868		

The same writer states that the value of the wool exported by Argentina in 1901 was $44,000,000 (a peso dollar equals 96.5 cents), while Australia, with 19,000,000 fewer sheep than Argentina, exported 127 per cent (in value) more wool than Argentina in 1901. Mr. Mayer makes the following observation regarding the sheep industry of Argentina:

Argentina has the greatest number of sheep of any country, but derives relatively the least benefit from them. This is due, in part, to the quality not having yet been sufficiently refined, in part to negligence in the care of the sheep,

and, lastly, to the prevalence of scab, the curing of which has not been made obligatory. In Australia curing this disease was made compulsory thirty years ago.

Exports of animals and animal products from Denmark, 1903.—The following statistics of exports for the year 1903 are reported by Hon. George H. Murphy, deputy consul-general at Frankfort, Germany:

Horses	number	24, 441
Cattle	do	62, 929
Beef	pounds	23, 290, 000
Ham and bacon	do	165, 330, 000
Mutton	do	770, 000
Other meat products	do	20, 154, 000
Butter	do	156, 560, 000

The greater part of these exported products went to England.

Imports and exports of animals and animal products of Uruguay.—Hon. John E. Hopley, consul at Montevideo, Uruguay, gives the following statistics regarding the imports of live stock and animal products for the years of 1902 and 1903:

Article.	Imports.		Exports.	
	1902.	1903.	1902.	1903.
Live stock	$801, 667	$966, 423	$611, 945	$859, 648
Slaughterhouse products			29, 737, 992	33, 832, 374

Trade in Animal Products with Trinidad.—Some statistics regarding the animal products of Trinidad are herewith reprinted from an article by Hon. William W. Handley, vice-consul at Trinidad:

Imports of animal products, 1901–2 and 1902–3.

Article.		1901–2.	1902–3.
Butter	pounds	567, 000	802, 000
Oleomargarine	do	226, 000	196, 000
Lard	do	1, 380, 000	1, 611, 000
Cheese	do	262, 000	281, 000
Milk, condensed	value	$96, 000	$110, 400
Meat, preserved	pounds	6, 000, 000	6, 300, 000
Oxen	number	6, 800	4, 700
Sheep, goats, and pigs	do	25, 000	26, 000

Mr. Handley states that very little fresh butter is made in Trinidad and that it is not likely that the colony will soon produce sufficient for its own uses. That which they have is received from Den-

mark, Canada, and France in tins; keg butter is chiefly from France. Trinidad people pay 48 cents per pound retail for butter. The United States has a monopoly on the imports of oleomargarine, lard, and cheese, but Canada has recently increased her supply of the latter about 50 per cent. The United States supplies seven-eighths of the fresh meat. Sheep do not thrive in Trinidad.

Imports of animal products from the United States, 1901–2 and 1902–3.

Article.	1901–2.	1902–3.
Butter	$39,009	$15,004
Lard	115,891	145,622
Horses	26,078	15,936
Mules	35,328	22,324
Leather, unmanufactured	7,752	10,406

Trinidad sold to the United States during the latter year $30,340 worth of hides and $15,360 worth of feathers.

Frozen-meat trade of Argentina.—Hon. D. Mayer, consul-general at Buenos Ayres, writing under date of September 22, 1904, states that three companies which were in operation in 1903 consumed 207,000 cattle and 3,428,000 sheep. There were eight other companies in course of formation, and these, with the three mentioned, will have the capacity to freeze annually 850,000 steers and 12,000,000 sheep, "representing 3 per cent of the cattle and 11 per cent of the sheep in the country." Mr. Mayer continues:

In 1903 the value of the meat exported from Argentina had already increased to $20,000,000. The exports of frozen mutton had increased from 2,722,000 carcasses in 1902 to 3,429,000, and the exports of frozen beef from 124,000 to 207,000.

Brazil consumes dried beef to the amount of about $6,000,000, paying for it, on board, 27 cents gold per kilo (2.2 pounds) when Argentine frozen beef is selling in London at 18 cents gold. It is true that the latter is with the bone, while the dried beef has none; but, on the other hand, there can be no hesitation in choosing between dried beef of not very good quality and frozen beef which preserves almost all the properties of fresh meat. Apart from this, the digestibility of the latter is infinitely superior to that of the former. Brazil, then, at least the marine cities and those on railways, such as Sao Paulo, will be one of the most propitious markets for Argentine frozen meat, and the transportation of it upon a large scale has already been initiated, after some experimental consignments that gave good results. In Rio de Janeiro, Para, and Manaos refrigerating stores have already been established, and very soon they will be constructed in Bahia and Pernambuco. Rio de Janeiro, Santos, Sao Paulo, Bahia, Pernambuco, Para, and Manaos have, in the aggregate, 1,200,000 inhabitants, who will consume frozen meat in preference to dried beef, though the latter will still be needed for some time in the interior of the country, until the means of transportation have been improved. That the consumption of

dried beef is diminishing is proved by the fact that in 1902 the value of the exports from Argentina was less by $230,000 than in 1901, and in the first quarter of 1903 it was less by $443,000 than in the corresponding period of the year 1902.

The cattle and sheep now possessed by Argentina do not give the quality of meat required for consumption in Great Britain, but if, besides the Brazilian markets, others be opened in Italy, Spain, Portugal, and on the Pacific coast, where people would be satisfied with meat as good as that which is consumed by the inhabitants of the city of Buenos Ayres, there will be considerable quantity of meat required for export. In Santiago, the capital of Chile, meat is three times as dear as in Buenos Ayres.

In this connection it is interesting to review the statistics of slaughter and of the slaughter products for a series of years, as published officially by the Province of Buenos Ayres, and which are as follows:

Animals slaughtered in refrigerating plants in Argentina, 1897–1903.

	Sheep.	Cattle.		Sheep.	Cattle.
	Number.	*Number.*		*Number.*	*Number.*
1897	2,232,526	13,752	1901	2,709,965	133,060
1898	2,597,795	17,904	1902	3,501,319	212,202
1899	2,569,185	31,690	1903	3,899,990	272,903
1900	2,564,678	68,982			

Products obtained from animals slaughtered in 1903.

Products.	Quantity.	Value.	Products.	Quantity.	Value.
	Pounds.			*Pounds.*	
Preserved meat	501,992	$115,701	Tallow	48,454,877	$5,817,545
Frozen meat	376,458,874	41,812,364	Bones	3,460,600	26,580
Fat	1,712,099	371,027	Horns	158,510	18,434
Hides:			Other products	5,447,136	1,293,818
Cattle	18,209,085	3,904,437	Total		59,775,815
Sheep	28,944,518	6,415,909			

German imports of animal products from Argentina.—During the year 1902 Germany imported animal products from Argentina to a considerable value. The figures for 1899 are also given for use in comparison.

Article.	1899.	1902.	Article.	1899.	1902.
Wool	$24,014,200	$18,397,400	Sheepskins	$214,200	$476,000
Salt hides	5,021,800	6,402,200	Entrails	95,200	357,000
Dry hides	785,400	642,600	Horse hair	190,400	214,000
Horse hides	690,200	880,600			

Exports of frozen meats from New Zealand—

[Compiled by Messrs. Dalgety & Co. (Limited), Christchurch, New Zealand.]

Year.	Pounds.	Year.	Pounds.
1882	1,707,328	1893	100,262,453
1883	9,853,200	1894	116,729,104
1884	28,445,228	1895	128,039,522
1885	33,204,976	1896	122,887,818
1886	38,758,160	1897	151,374,309
1887	45,035,984	1898	159,223,720
1888	61,857,376	1899	188,992,760
1889	73,564,064	1900	192,074,451
1890	100,934,756	1901	191,440,971
1891	110,199,082	1902	226,904,414
1892	97,636,557	1903	243,903,438

New Zealand's exports of animal products.—The table given herewith, which shows the value of the exports of animal products from New Zealand for the fiscal years ended June 30, 1903 and 1904, is compiled from information published by Hon. F. Dillingham, consul-general at Auckland, New Zealand:

Exports of animal products.

Article.	1902–3.	1903–4.
Wool and sheepskins	$22,477,705	$23,667,445
Frozen meat	16,550,365	14,230,410
Butter and cheese	6,988,175	8,202,965
Tallow	2,744,805	1,835,395
Total	48,761,050	47,936,210

Oleo oil in Turkey.—Hon. Rufus W. Lane, consul at Smyrna, Turkey, in writing to the Department of State on the trade outlook for American goods in Asia Minor, says the following regarding oleo oil:

Oleo oil is a new article introduced for the first time last year from the United States solely. Its low price has caused it to be easily disposed of, and it is found to be a very acceptable substitute for the expensive Russian butter. There is, I believe, a promising outlook for good business in this article. Difficulties placed in the way of its introduction by the chemical bureau of the Turkish Government have greatly delayed the entry of a recent shipment, but with the assistance of our legation and consulate-general in Constantinople we have obtained its acceptance as a noninjurious article of food, so that I do not apprehend trouble with future shipments.

Number of sheep slaughtered in refrigerating plants in Argentina, 1897–1903.—The following table from Boletin Mensual shows

the number of sheep slaughtered in Argentine refrigerating plants for the years 1897 to 1903:

1897	2,232,526	1901	2,709,965
1898	2,597,795	1902	3,501,319
1899	2,569,185	1903	3,899,990
1900	2,564,678		

Number of sheep in Australasia, 1885–1902.—The table given herewith, showing the number of sheep in the several colonies of Australasia for the years of 1885 to 1902, is from "A statistical account of Australia and New Zealand," edited by Mr. T. A. Coghlan, statistician for New South Wales:

Year.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia	Tasmania.	New Zealand.	Total.
1885	37,820,906	10,681,837	8,994,322	(a)	1,702,719	1,648,627	16,564,595	77,409,006
1886	39,169,304	10,700,403	9,690,445	(a)	1,809,071	1,609,046	(a)	62,978,269
1887	46,965,152	10,623,985	12,926,158	(a)	1,909,940	1,547,242	(a)	73,972,477
1888	46,503,469	10,818,575	13,444,005	(a)	2,112,392	1,430,065	15,468,860	89,777,266
1889	50,106,768	10,882,231	14,470,095	6,432,401	2,366,681	1,551,429	15,503,263	101,312,868
1890	55,986,431	12,692,843	18,007,234	7,050,544	2,524,913	1,619,256	18,128,186	116,009,407
1891	61,831,416	12,928,148	20,289,633	7,745,541	1,962,212	1,664,218	18,570,752	124,991,920
1892	58,080,114	12,965,306	21,708,310	7,209,500	1,685,500	1,623,338	19,380,369	122,652,437
1893	56,980,688	13,098,725	18,697,015	7,325,003	2,200,642	1,535,047	20,230,829	120,067,949
1894	56,977,270	13,180,943	19,587,694	(a)	2,132,311	1,727,200	19,826,604	113,432,019
1895	47,617,687	(a)	19,856,959	(a)	2,295,832	1,523,846	19,138,493	90,432,817
1896	48,318,790	(a)	19,593,696	6,402,593	2,248,976	1,650,567	19,687,954	97,902,576
1897	43,952,897	(a)	17,797,883	5,092,078	2,210,742	1,578,611	19,673,725	90,305,936
1898	41,241,004	(a)	17,552,608	5,076,695	2,251,548	1,493,638	19,348,506	86,964,000
1899	36,213,514	(a)	15,226,479	5,721,493	2,282,306	1,672,068	19,347,346	80,463,206
1900	40,020,506	(a)	10,339,185	5,283,247	2,431,861	1,683,956	19,355,195	79,113,950
1901	41,857,099	10,841,790	10,030,971	5,060,540	2,542,844	1,792,481	20,233,099	92,358,824
1902	26,649,424	(a)	7,213,985	4,922,662	2,697,897	1,679,518	20,342,727	63,506,213

a Returns not collected.

The sheep of Abyssinia.—Hon. Robert P. Skinner, United States commissioner, Marseille, France, writes as follows regarding the sheep of Abyssinia:

The sheep of the low plains are all of the fat-tailed variety, peculiar also to Syria. The dominating breed is white in color, with black head. In the high countries a reddish white and gray breed is raised. The meat in all cases is excellent. None of the varieties mentioned have any fleece, and no attempt seems to be made to introduce a wool-bearing species. In the Menz Province a race of very small black sheep, the flesh of which is particularly fine and desirable, is raised for wool. The clip is taken up locally for the manufacture of coarse cloaks, worn in the cold countries. The price of a sheep varies between 38 cents and $1.93, and there is an important exportation to Djibouti, Aden, and the Red Sea coast. An approximate estimate of the number of sheep and goats in Abyssinia places the total at 20,000,000. The bones, blood, and a large part of the grease of these animals are not utilized. It seems quite certain that when means of transportation exist a strong effort will be made to introduce

wool-bearing breeds, which could be grown with the same limited care now given to the native varieties and would prove a source of great wealth to the country.

Imports of wool at Boston, New York, and Philadelphia.—

Wool imported into Boston, New York, and Philadelphia during the year ended June 30, 1904, by countries and classes.

Country of production.	Classification.			Total.
	Class 1.	Class 2.	Class 3.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Austria-Hungary			716,417	716,417
Belgium	29,432		135,070	164,502
Malta, Gozo, etc			238,134	238,134
Denmark			559,818	559,818
France	9,271		1,284,489	1,293,760
Germany	37,140	10,097	1,455,549	1,502,786
Iceland			616,939	616,939
Italy	2,593		249,064	251,657
Netherlands			116,727	116,727
Portugal	7,151	10,098	709,510	726,759
Roumania			1,108	1,108
Russia in Europe			17,966,335	17,966,335
Servia			297,067	297,067
Spain	1,271		1,144,478	1,145,749
Sweden and Norway—Norway	20			20
Switzerland			75,552	75,552
Turkey in Europe		167,484	2,240,433	2,407,917
England	245,617	5,591,793	1,895,457	7,732,867
Scotland	56,652	92,337	17,668,405	17,817,394
Ireland		1,250,155	6,626	1,256,781
Nova Scotia	9,909	105		10,014
British West Indies	160			160
Dutch West Indies	39		9,426	9,465
Argentina	18,018,443	100,548	10,049,069	28,168,060
Brazil	129,485		101,671	231,156
Chile	544,895		513,822	1,058,717
Falkland Islands	63,319			63,319
Peru		1,109,286		1,109,286
Uruguay	112,208			112,208
Venezuela			36,407	36,407
Aden			1,731	1,731
Chinese Empire			24,912,491	24,912,491
British East Indies	19,733	86,937	9,981,886	10,088,556
Dutch East Indies			14,458	14,458
Japan			20,112	20,112
Russia—Asiatic	1,016		5,436,446	5,437,462
Turkey in Asia	17,912	1,790,186	13,526,458	15,334,556
Asia, all other	2,366	242,570	2,284,746	2,529,682
British Australasia	25,792,098			25,792,098
British Africa	301,182	280,616	781	582,579
French Africa		189		189
Africa, all other	45			45
Total	45,401,957	10,732,401	114,266,682	170,401,040

The Australasian wool clip.—The following table shows the amount of wool produced in Australasia in 1902 and for the four other years, which are given for comparison:

State.	1871.	1881.	1891.	1901.	1902.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
New South Wales	74,401,300	161,022,900	321,416,000	301,942,000	221,565,900
Victoria	63,641,100	67,794,300	69,205,600	74,879,300	65,490,400
Queensland	36,553,200	34,275,300	83,118,100	70,141,800	41,659,100
South Australia	28,242,100	46,013,900	50,151,500	39,951,700	36,862,600
Western Australia	1,888,000	4,654,600	9,501,700	14,049,000	13,377,700
Tasmania	6,687,800	10,525,100	10,102,900	8,939,000	8,304,400
Commonwealth	211,413,500	324,286,100	543,495,800	509,902,800	387,260,100
New Zealand	46,192,300	69,055,600	117,733,500	164,011,500	167,448,100
Australasia	257,605,800	393,341,700	661,229,300	673,914,300	554,708,200

The average weight of fleeces has increased gradually since 1861. For 1901 the average weights for the several colonies were as follows: New South Wales, 7.2 pounds; Victoria, 6.9 pounds; Queensland, 7.1 pounds; South Australia, 7.9 pounds; New Zealand, 8.1 pounds. The average for the United States in 1904 was only 6.5 pounds.

Wool exports from Australasia.—The production of wool in Australia for the year 1903-4, according to Hon. John P. Bray, consul-general at Melbourne, was 995,000 bales (a bale equals 300 pounds). With New Zealand added, we have a total production for Australasia of 1,366,942 bales, which is a decline from the last previous year of 73,780 bales. The exportation of wool from Australia from 1897 to 1904 is shown in the following tabular statement:

	Bales.		Bales.
1896-97	1,848,509	1900-1901	1,609,713
1897-98	1,718,720	1901-2	1,664,885
1898-99	1,664,517	1902-3	1,440,722
1899-1900	1,594,464	1903-4	1,366,942

The amount of $44,054,200 was received for the wool exported from Australia in the last year named. With New Zealand added, the total value was $50,233,280.

Production of wool in Argentina and Uruguay, 1893-1903.—The following table, compiled from fiscal reports, shows the amount of wool produced in Argentina and Uruguay for the eleven years 1892-93 to 1902-3:

Year.	Argentina.	Uruguay.	Year.	Argentina.	Uruguay.
	Pounds.	*Pounds.*		*Pounds.*	*Pounds.*
1892-93	109,500,000	20,100,000	1898-99	146,100,000	25,500,000
1893-94	117,600,000	25,500,000	1899-1900	135,300,000	25,800,000
1894-95	147,900,000	27,000,000	1900-1901	121,500,000	25,500,000
1895-96	150,000,000	29,700,000	1901-2	130,500,000	25,800,000
1896-97	145,000,000	27,000,000	1902-3	136,500,000	30,000,000
1897-98	148,500,000	27,000,000			

Production and consumption of meat and dairy products in United Kingdom.—The Royal Statistical Society in 1900 appointed a committee "to inquire into the statistics available as a basis for estimating the production and consumption of meat and milk in the United Kingdom." Mr. R. H. Rew, of this committee, has given out the following statistics. The first table gives the average annual production based upon the five years ended with 1903:

Beef and veal ....tons..	662, 520
Mutton and lamb..............do....	313, 822
Bacon and pork..............do....	269, 578
Total meat..............do....	1, 245, 920
Cheese ....do....	68, 300
Butter ....do....	160, 550
Milk (for consumption as milk)..............gallons..	620, 000, 000

The estimated average consumption per capita of these commodities, including imported supplies, is as follows:

Article.	Home produced.	Imported.	Total.
Beef and veal ....pounds..	35.9	20.9	**56.8**
Mutton and lamb..............do....	17	10.5	**27.5**
Bacon and pork..............do....	14.6	22.2	**36.8**
Milk..............gallons..	15	....	**15**
Cheese ....pounds..	3.7	6.8	**10.5**
Butter..............do....	8.7	9.8	**18.5**

Decline of British butter making.—The following, with reference to the decline of butter manufacture in England, is from Hon. Frank W. Mahin, United States consul at Nottingham, England:

One plausible explanation of the manifest decline in dairying in England is that it is more profitable to sell the milk, the drinking of which is increasing, than to convert it into butter. Consequently the average British farmer is making no butter to sell, but is even buying what he needs for his own use. Furthermore, it is asserted that some English dairies buy foreign butter and sell it as their own product—the domestic article, though inferior, in the judgment of many consumers, commanding a higher price than the foreign.

Cool-cured cheese in Canada.—Several lots of cheese from the Canadian government cool-curing rooms were sent to Great Britain for the special purpose of getting a report on its quality as compared with the cheese cured at ordinary temperature. The cheese was examined by members of the trade in various localities. A committee that examined one lot reported as follows, expressing the desire that cool curing be made compulsory:

(1) Cool curing during the summer months is a decided improvement over the ordinary method, and improves the quality of the

cheese not less than 2s. (48 cents), and in some cases 4s. (97 cents) per hundredweight (112 pounds).

(2) Paraffining is an improvement when thoroughly applied on well-made, close-textured cheese, but does harm on soft, mushy, and acidy cheese.

Consumption of butter in Germany.—According to Hon. H. W. Harris, United States consul at Mannheim, Germany, the consumption of butter is on the increase in Germany. Contrary to what one would expect, this increased consumption is especially due to the introduction of cream separators, which have there, as elsewhere, operated to increase the output. Previous to the year of 1895 the exports of German butter had exceeded her imports, but in that year the imports exceeded the exports by 233 tons. The excess of imports over exports in 1900 reached 13,129 tons. The total imports were 15,800 tons in 1902 and 23,388 tons in 1903. During the last year the sources of the larger quantities of these imports were Holland, with 7,671 tons; Russia, including Siberia, with 7,654 tons; Austria-Hungary, with 4,669 tons; and Denmark, with 2,340 tons.

Glazed butter in Germany.—The following is reported by Hon. Richard Guenther, consul-general at Frankfort, Germany:

Under the caption "Glazed butter," German papers state that it has long been known in Germany that butter can be glazed by the use of sugar; that is, it can be coated with a glass-like sugar covering. This method, the papers state, seems to become of some importance, as it recently has been used on a large scale in England for butter sold in forms.

The Druggists' Journal calls attention to the usefulness of this innovation and says that butter so treated keeps fresh for a longer time than if not treated. It is first carefully kneaded and washed, then put into forms weighing 1 pound each, and placed in a cool room. The glazing is done by painting the surface with a hot sugar solution. The brush used should be very soft and the painting should be done quickly. The sugar solution melts the surface of the butter, and the sugar and melted butter form a sort of varnish which protects the butter against deterioration from outside influences.

Dairy methods in Mexico.—The primitive methods of dairying in Mexico are stated succinctly in the following, from Consul A. J. Lespinasse, at Tuxpan, Mexico:

The old methods of milking, churning, and general manipulation of milk products are still in existence, thereby rendering it impossible to produce good butter. Cows are allowed to roam over the grazing lands and are rarely sheltered or given the least care. The milking process is performed in the most unskillful manner conceivable. The cow is tied by the head and the operator proceeds to milk the animal in his rough and unsystematic manner until he finally forces a quart or two of inferior milk from the cow's udder. The milk is placed in untidy wooden vessels and transferred to some shed or outhouse,

where it is allowed to remain unprotected overnight. The following morning the cream is skimmed and either beaten with a forked switch or violently agitated in a bottle until the butter granules are formed. It is then indifferently washed and offered as butter. It quickly turns rancid. It sells for from 75 cents to $1 (30 to 40 cents United States) per pound at retail. It is neither good to look at nor to taste.

Milk sells for 10 cents (4 cents United States) a quart and 6 cents (2.4 cents United States) a pint. The whey is compressed in coarse cloth, salted, and allowed to dry several days. It is then an insipid spongy mass, which sells for 12 to 18 cents (4.8 to 7.2 cents United States) a cheese, which is round, about 1 inch thick and about 5 inches in diameter; it finds a quick sale in this market. Such a thing as the most simple modern appliance is unknown, or at least never used.

Production and exportation of butter in Argentina.—The Boletín Mensual, the official statistical publication for the Province of Buenos Ayres, says that the production of butter in that province in 1902 was 7,352 metric tons (16,208,383 pounds), and in 1903 was 8,243 metric tons (18,172,719 pounds). The amount of butter (pounds) exported during the four years of 1900–1903, was as follows:

1900	2, 599, 247
1901	3, 328, 976
1902	9, 094, 058
1903	17, 703, 099

Some dairy statistics of Queensland.—The following statistics for 1903 are from a report by Hon. F. W. Goding, consul in New South Wales:

Total milk used for butter	gallons	18, 750, 604
Butter factories	number	4, 327
Cream produced	gallons	13, 717, 841
Cream furnished to factories	do	6, 261, 049
Butter produced	pounds	7, 717, 325
Butter exported (in round figures)	do	1, 750, 000
Cheese produced	do	1, 479, 651
Cheese factories	number	61
Condensed-milk factories	do	3
Value of condensed milk produced		$62, 067

Milk-powder factory in France.—A company composed of Americans and Frenchmen have built a factory for reducing milk to powder at La Rochelle, France, according to a report by Hon. George H. Jackson, consul at that place. The capacity of the factory is 2 tons of powder a day, which represents 5,000 gallons of milk. This factory is located in the center of a dairy district. It is said that the chocolate manufacturers are preparing to profit by its presence.

Galalith from skim milk.—Visitors to the exhibit of the Bureau of Animal Industry at the Louisiana Purchase Exposition will remember seeing there a case of articles made from petrified skim milk, or galalith. Hon. Richard Guenther, consul-general at Frankfort, Germany, tells how it is made and what it is made of in the following paragraph:

By a chemical process the casein is precipitated as a yellowish-brown powder, which is mixed with formalin. Thereby a hornlike product is formed called "milk stone." This substance, with various admixtures, forms a substitute for horn, turtle shell, ivory, celluloid, marble, amber, and hard rubber. Handles for knives and forks, paper cutters, crayons, pipes, cigar holders, seals, marble, stone ornaments, and billiard balls are now made of skim milk. The insolubility of galalith, its easy-working, elasticity, and proof against fire make it very desirable. Already 20,000 quarts of skim milk are daily used for this purpose in Austria.

Butter, cheese, poultry, and eggs in Kansas.—The Fourteenth Biennial Report of the State Board of Agriculture gives some interesting statistics regarding the value of butter, cheese, and eggs produced in 1903 and 1904. In order that the progress in these several lines may be shown clearly, data for previous years back to 1899 are shown.

Year.	Poultry and eggs.	Cheese.		Butter.	
		Pounds.	Value.	Pounds.	Value.
1899	$4,241,869	1,163,680	$104,730.20	43,082,767	$5,775,523.07
1900	5,060,332	1,441,174	144,117.40	41,745,759	6,641,692.06
1901	5,950,076	1,456,093	145,609.30	43,771,076	6,880,143.44
1902	5,706,352	3,025,655	302,565.50	44,350,829	7,517,331.65
1903	6,498,856	1,568,533	156,843.30	46,222,022	7,876,227.40
1904	7,551,871	1,781,728	178,172.80	42,862,366	7,021,229.84

Consumption of poultry and eggs in Great Britain.—An English expert has stated that the annual consumption of eggs in Great Britain amounts in value to $63,836,893, and the value of the poultry and game consumed amounted in value to $20,303,968; total, $84,140,861.

Testing for age of eggs.—Hon. Richard Guenther, consul-general at Frankfort, Germany, reports the following information regarding a simple method of testing for the age of eggs:

A new and simple method for testing eggs is published in German papers. It is based upon the fact that the air chamber in the flat end of the egg increases with age. If the egg is placed in a saturated solution of common salt it will show an increasing inclination to float, with the long axis vertical. A scale is attached to the vessel containing the salt solution, so that the inclination of the floating egg toward the horizontal can be measured. In this way the age of the

egg can be determined almost to a day. A fresh egg lies in a horizontal position at the bottom of the vessel. An egg from 3 to 5 days old shows an elevation of the flat end, so that its long axis forms an angle of 20°. With an egg 8 days old the angle increases to 45°; with an egg 14 days old, to 60°, and with one 3 weeks old, to 75°, while an egg a month old floats vertically upon the pointed end.

The Sicilian, or Buttercup, breed of chickens.—The Sicilian chickens, as the name signifies, are from the island of Sicily. They were first brought to the United States, about 1863, by Cephas Dawes, of Dedham, Mass., who was a sea captain. Captain Dawes had a cargo of oranges, raisins, and figs destined for America and took on board a coop of these chickens as a supply of fresh meat during the voyage. The hens laid so many eggs, and large ones, that it was decided not to kill them; so he took them to his home. One of his neighbors, C. Carroll Loring, Dedham, Mass., observed the excellent laying qualities of the fowls and secured some of the stock for himself, and he has preserved the stock pure all these years.[a]

Only one other importation has been made, so far as any available record shows, and that one was by John B. Gough, the late well-known temperance lecturer, whose home was at Worcester, Mass.

The male is described by Mr. Loring as of a reddish butter color with neck hackle a little darker. The comb is in the shape of a cup, and this form, together with the color, caused Mr. Loring to give to them the local name of Buttercup. The females are laced somewhat on the back and are lighter in color than the males.

The mature males weigh from 5½ to 7½ pounds, and the females from 4½ to 6 pounds. The dressed fowl is plump and very yellow.

The Sicilian is of a quiet disposition, yet vigorous and always busy. They are very prolific, and the eggs are said to be exceptionally large and beautifully white. The advocates of this breed believe it can, by proper selection in breeding, soon be made to produce 300 eggs per year. It has already considerably exceeded the 200 mark.

It is also claimed for this breed that they are nonsitters, which means that they are not much inclined to sit.

Utility Poultry Club's laying competition.—We have received the results of the eighth annual laying competition of the Utility Poultry Club, which commenced on October 10, 1904, and concluded on January 29, 1905, a period of sixteen weeks. Each pen consisted of four pullets, hatched in 1904. The results are very instructive and satisfactory. Thirty-six pens were entered; the total number of eggs laid was 5,066, giving an average of over 140 eggs to each pen. The birds were kept in fair-sized runs and the majority of them

[a] Mr. Loring has kindly furnished valuable information for this note.

increased considerably in weight during the sixteen weeks. The most remarkable circumstance connected with the competition was the proof of the great inferiority of fancy-feathered fowls as layers, the 8 prize-winning pens being 7 white and 1 buff. The prizes were as follows:

First, White Leghorns, Mr. Cheatle, Tamworth, 245 eggs; second, White La Bresse, Mr. Wood, Pebmarsh, 240 eggs; third, White Wyandottes, Mr. Watson, Cambridge, 226 eggs; fourth, White Wyandottes, Mrs. Dawson, York, 187 eggs; fifth, White Leghorns, Mr. Orlebar, Wellingborough, 178 eggs; sixth, White Wyandottes, Antrim C. C. Poultry Farm, 180 eggs; seventh, Buff Orpingtons, Mr. Wimble, Kent, 175 eggs; eighth, White Wyandottes, Mr. Stevens, Essex, 154 eggs.

The manager's report is most creditable, proving not only the utility of the competition, but the extreme care with which it was conducted. The weather at the commencement was mild, but the winter at Royston was one of the severest known for many years. The health of the birds was, generally speaking, very good, although some of them molted and others became broody, affecting the number of eggs laid during the competition. In the matter of health the Wyandottes were found to require the most care and attention. All the birds were fed exactly alike while they remained in the laying houses. When any change of treatment was advisable they were at once removed. The houses faced south, were open-fronted with canvas shutters. The floors were of dry dust covered with deep straw. The 144 birds were supplied with 9 pounds of food in the morning, consisting of meat, bran, meal, and vegetables scalded together overnight. Grain was given to the birds at midday and night, oats being the staple food. No spices, condiments, or patent foods were used.

That the whole of the winning pens, with one exception, should have been white does not prove, as might at first sight be imagined, the superiority of white breeds over others. The White Wyandottes were, as the manager remarks, delicate and required considerable attention, and some of them were among not only the best but the worst layers. What it does prove is that, there being no necessity to consider the plumage, attention was directed to the increase of egg production. The absence of fancy fowls from the list is remarkable; the breeders of show poultry apparently knew instinctively they had no chance and did not enter into the competition.

One remarkable fact is that, although Leghorns are entered freely and among the best layers, not one single pen of Minorcas was included. This is a most lamentable result. The old, useful Spanish fowl has been bred by exhibitors almost out of existence, attention having been devoted to abnormally large combs and large ear lobes.

Exhibitors of show Minorcas for the last few years have been following the example of those who ruined Spanish. The ridiculously large combs necessary to win at the Crystal Palace and Birmingham have been bred for until the fowl has become useless from the size of the comb interfering with the sight of the bird and requiring artificial treatment for its support. With the persistent cultivation of feather and fancy points to the entire exclusion of useful properties, the Minorca has so degenerated as to have become almost worthless for utilitarian purposes. Fortunately, the allied bird, the Leghorn, has not been treated in the same way, and the result is that we find it among the leading birds of this competition. It is satisfactory to quote the following note of the manager, and the club may be congratulated altogether upon its useful work:

The competitions are not given to determine which is the best breed. The club recognizes that good laying is a question of strain and not of breed, and endeavors, by means of these competitions, to make known those fowls which, under a systematic treatment during the four worst months of the year, have proved themselves to be good layers.—(*The Field, London, February 18, 1905.*)

Australian egg-laying competition.—The particulars given herewith are gleaned from the official report of the Hawkesbury Agricultural College, New South Wales, where this second annual competition took place.

The competition lasted an entire year, thus giving both winter and summer results. Each pen contained six pullets from 7 to 12 months old, no male bird was allowed, and each pen to one definite breed only. There was a run for each pen 87 feet long and 17 feet wide, which contained plenty of green feed in the form of conch grass. The birds were fed as follows: At 7 a. m. a meal of mash made with two-thirds pollard and one-third bran in milk. For two days in each week this mash was mixed with liver soup and on other days with warm water. A heaped imperial pint of the mash was given to each pen, but no food was left in the pens. At 4.30 p. m. grain was fed, crushed corn and wheat being given on alternate days. For the animal food liver was found to be cheaper and better than crushed bone. Seashell grit was given to provide lime for the shells. The houses were cleaned and the feeding utensils scrubbed weekly. The eggs were gathered daily.

The competition ended in March, 1904, and the winner of the highest prize was a pen of Silver Wyandottes that averaged 218 eggs per hen for the year. They were described as rather small in size and moderate eaters. The winner, from an economic point of view, however, was a pen of Brown Leghorns from America. They averaged over 200 eggs per hen and "as profit givers stood alone, as they produced their great tally of eggs on half the average quan-

tity of food consumed by all the pens." The competition demonstrated the advantage of breeding from those hens that were known to produce the most fertile eggs.

Goat raising in Mexico.—The subjoined information regarding goat raising in Mexico is from a report by Hon. William Headen, consular agent at Puebla, Mexico:

The ordinary domestic goat, so well known in the United States, is the species raised throughout Mexico. It is valued for its pelt, its tallow, and its flesh, both fresh and dried. As yet no use has been made of either horns or hoofs. In the vicinity of San Luis Potosi the entrails have been spun into long strings of so-called "catgut," and the finer and more delicate strings have been profitably exported by mail, in small parcels, to Chicago and New York.

The ordinary goat, when slaughtered, yields 4 pounds of dried meat and 6 pounds of refined tallow, which, together with the skin, are worth here in the home market, in Mexican silver, $3.46 ($1.57 in gold)—the 4 pounds of dried meat, at 20 cents, 80 cents; the 6 pounds of refined tallow, at 16 cents, 96 cents; the cured skin, 2 pounds, at 85 cents, $1.70. The original cost of goats for breeding purposes is, on an average, $2.50 a head in Mexican silver ($1.10 in gold). The common goat, well cared for, is hardy and well suited to the country. It breeds four times in three years.

The goats of Abyssinia.—Hon. Robert P. Skinner, United States commissioner, Marseille, France, writes as follows regarding the goats of Abyssinia:

Goats are particularly numerous in the low and middle altitudes of the Empire. They may be classed under two heads—long and short haired animals. The hair of the last named frequently acquires extraordinary length, and the animals from the Arroussi country furnish a very fine, silky hair, sometimes 15.75 inches in length. Goat hair is not utilized. The skins are exported or used for the manufacture of water sacks. The native breeds are very prolific. A full-grown animal sells at from 38 cents to $1.54. The flesh is excellent, and the peculiar odor which makes it undesirable in other countries is entirely absent. Among the Abyssinians the flesh of the goat is preferred to that of the sheep.

Reindeer hair and its uses.—Hon. Henry Bordewich, consul-general at Christiania, Norway, makes the following remarks concerning the uses of reindeer hair:

Trials have been made in Norway at different times and by different manufacturers to make use of reindeer hair for the manufacture of textiles. The fiber has been tried both separately and in connection with wool, but it has been found worthless for the purpose. Not even in the coarsest fabrics, such as door mats, rugs, inside soles in shoes, etc., is it available. The reason for this is its brittleness. Every hair is a diminutive cylinder. The only parts of the reindeer with different covering is the front of the head and the lower parts of the legs. The skin from these parts is used for shoe packs, caps, and mittens. The hair from the reinder is largely used in Norway in the place of cork for filling in life belts, cushions, and mattresses for use on board ships. The buoyancy of the hair is said to be greater than that of the best cork.

Frozen-rabbit industry of Australia.—The following bit of information is interesting, and shows the importance of the industry in Australia. The information is given by Hon. John P. Bray, consul at Melbourne:

The exports of frozen rabbits show considerable expansion. The figures are as follows:

	Pairs.
1900	2,839,112
1901	2,092,727
1902	3,274,210
1903	3,650,000

This industry has become an important one in Victoria. Over 20,000,000 rabbits are utilized during the year for export purposes. Of these, 7,300,000 were exported frozen in the fur and from 10,000,000 to 12,000,000 skins were shipped and a large number of these animals tinned and disposed of.

Rabbits v. sheep in Australia.—A letter in the March (1904) number of the American Sheep Breeder contains the following paragraph regarding the rabbit pest in Australia in relation to sheep raising in that country:

Some readers probably think that too much has been made of the rabbit pest as a factor in preventing restocking with sheep in Australia, but it is almost impossible to exaggerate the dire effects of this plague throughout the entire Commonwealth, except the State of Western Australia. A correspondent, writing under date of January 18, who had just returned from a visit to Fowlers Bay and other portions of the southern coast, states that the farmers in that district are at their wits' ends, and have very poor crops this year. When all herbage has been devoured, "the rabbits," he affirms, "climb the trees and actually eat the bark, after finishing the leaves." But we will quote an appeal which Mr. Samuel McCaughey, of Coonong, has made to the New South Wales government on the subject, merely promising that he is the largest owner of sheep in the world, and before the drought on his various properties depastured no fewer than 1,250,000 sheep:

"The matter before the council is the most important that could be considered either by the council or by Parliament at the present time. Large areas of country are being abandoned every year, principally owing to rabbits. I am confident that a large portion of the western district of New South Wales can not be profitably occupied, unless some disease is introduced to deal with the pest. There are large areas of rough country in the west and southwest of this division where too many acres per sheep are required to make it possible to destroy the rodents by any method at present in use and at the same time to make a profit off the country. The number of sheep now in the State is somewhere about 30,000,000, and I do not think the number will be much increased while present methods of destroying the rabbits are the only ones in use. If a disease were introduced to enable us to eradicate the rabbits, I am confident that we could get up to 60,000,000 in a few years, which would mean prosperity to both town and country."

Transportation in Persia.—Something about the carrying capacity of the camel, the mule, and the ass is given in the following para-

graph, copied from an article by Hon. John Tyler, vice-counsul at Teheran, Persia:

As the camel, the mule, and the ass are still the vehicles of the interior transport of Persia, it will be readily understood that the carrying capacity of each animal is limited, and as the roads are in certain places rather narrow the size of the packages are circumscribed. Camels will carry a burden of 520 pounds, or two packages of 260 pounds each; mules 326 pounds, or two packages of 163 pounds each; donkeys, 240 pounds, or two packages of 120 pounds each.

Horses, cattle, and meat in France.—Imports of horses into France have risen from 17,561 head, worth 12,184,000 francs ($2,351,512) in 1902, to 19,022 head, valued at 12,928,000 francs ($2,495,104) in 1903. There were increases in the imports of horses, mares, and colts. Algeria remains the principal source of supply for stallions; geldings and mares come principally from Austria-Hungary, Belgium, and England.

While the imports have increased equine exports have decreased, namely, 19,089 head, valued at 20,331,000 francs ($3,923,883) in 1903, against 23,227 head, valued at 24,103,000 francs ($4,651,879), in 1902.

Imports of cattle, sheep, and hogs into France in 1902 and 1903.

Animals.	1902.		1903.	
	Number.	Value.	Number.	Value.
Oxen	30,393	$1,645,518	28,740	$1,777,723
Cows	4,991	198,790	5,022	220,406
Heifers	2,204	93,219	2,542	94,956
Calves	5,509	71,796	5,057	68,901
Sheep	1,508,101	7,414,095	1,623,999	8,638,487
Hogs	4,018	74,691	8,860	178,911
Total	1,555,216	9,498,109	1,674,220	10,979,384

Nearly all of the beef cattle and nine-tenths of the sheep are from Algeria and Tunis. The imports of sheep from Austria-Hungary have decreased considerably. France exported oxen to the number of 14,783 in 1903, against 16,725 in 1902; cows, 8,495, against 9,830, and hogs, 26,210, against 36,704 in the same years.

The receipts of cattle, sheep, and swine at the market of Villette, Paris, in 1903 were 247,059 oxen, 169,523 calves, 48,365 cows, 1,894,539 sheep, and 513,916 hogs, against 247,317 oxen, 176,242 calves, 56,185 cows, 2,382,781 sheep, and 503,091 hogs in 1902.

In the aggregate the entries of cattle show a slight diminution.

The mean price of beef remained stationary during the first six months of 1903, but in the second half year there was an appreciable rise as a result of the abundance of straw and fodder, leading the

growers to keep over more animals and therefore to limit shipments to market. A rise is also shown in the price of mutton and pork.

The imports into France of meat, salted or otherwise preserved, have fallen from 25,132,690 pounds, valued at $4,541,290, in 1902, to 24,008,336 pounds, worth $4,371,450, in 1903. The principal changes were in the amounts of imports of fresh beef, salt pork, and game, which in 1903 amounted to 2,639,374, 9,553,295, and 3,676,562 pounds, respectively, against 2,881,221 pounds of fresh beef, 9,760,881 pounds of salt pork, and 4,269,691 pounds of game in 1902.

Among the countries supplying France are: Switzerland, fresh beef; Belgium, fresh mutton, pork, and meat extracts; England, Germany, Belgium, and the United States, salt pork; United States and Italy, sausages; Italy, Austria-Hungary, and Germany, game. According to the reports of the octroi, 424,477,088 pounds of meat were delivered in Paris in 1903 and 430,603,033 pounds in 1902.

The imports of fats or greases rose from 35,757,870 pounds, worth $2,539,880, in 1902, to 57,395,578 pounds, worth $3,865,790, in 1903. The principal sources of supply were, as before, the United States, Uruguay, Argentina, England, and China. Exports suffered a decrease from 85,340,926 pounds, worth $6,518,382, in 1902, to 80,204,160 pounds, valued at $5,374,278, in 1903.—(*From Annales du Commerce Extérieure, 1904.*)

Poultry and eggs in the United Kingdom.—In a brief report on the poultry business in the United Kingdom, by Hon. Frank W. Mahin, consul at Nottingham, some items of importance are given. He states that the production of eggs is increasing, and yet the British farms can accommodate three times as much poultry as they now have. This latter fact seems strange when it is known that fresh eggs average during the year about 3 cents apiece and a fowl for table 80 cents. Artificial incubation is more generally adopted now than hitherto. Formerly the loss of incubator chicks was sometimes 50 per cent, but now it is reduced to 5 or 10 per cent. Another observation is that the quality of eggs and poultry is rapidly improving under scientific methods. Cooperation and technical instruction in agricultural colleges are mentioned as important factors in the present development of the industry.

The imports of poultry and eggs into this country in 1902, 1903, and 1904 were valued at $31,000,000, $33,000,000, and $33,500,000, respectively, the small increase in 1904 being attributable mainly to the enhanced home production, though partly due perhaps to the hard times. As usual, Russia was the largest contributor of eggs—35 per cent of the entire import—and Denmark, with 18 per cent, was next. The United States does not appear separately, but is perhaps included

with "other countries" furnishing 6 per cent. In the poultry list, however, the United States stands fourth, with a value of $1,069,593 out of a total of $5,299,833—Russia leading, with $1,672,913, and Belgium and France coming next, each with somewhat more than our country.

It is estimated that the total consumption of eggs and poultry in the United Kingdom for 1904 amounted to $88,000,000. This left $57,000,000 for the home product, a proportion which it is believed can be largely increased without the displacement of any other product.

Municipal slaughterhouse of Berlin.—Hon. Frank H. Mason, consul-general at Berlin, gives the following interesting information regarding the municipal slaughterhouse of Berlin:

The local regulations provide for a rigid inspection of all animals which are to be slaughtered for food, and require that they shall be killed and dressed at the municipal slaughterhouse, under the direction and inspection of specially qualified officials. Not only the living animal, but its flesh when dressed, is inspected and stamped before it may be legally offered for sale. During 1903 there were killed and prepared for market at the municipal slaughterhouse in Berlin 153,426 cattle, 156,984 calves, 413,388 sheep, 895,206 swine, and 11,818 horses. The annual meat consumption ranges from 162 to 180 pounds per capita for the entire population of Berlin.

REPORT OF THE WORK AGAINST SCABIES OF SHEEP AND CATTLE IN 1904.

By C. O. GOODPASTURE,
Of the Inspection Division, Bureau of Animal Industry.

A long-range view must be taken of the work against this troublesome disease in order to obtain a true conception of its results. The present conditions in a particular State or locality must be compared with the conditions that existed when the disease was at its worst and before any systematic campaign against it had been inaugurated, for it must be borne in mind that instead of dying out or running a course and disappearing scabies spreads rapidly and is only eradicated by well-organized and persistent effort.

THE WORK AGAINST SHEEP SCAB.

The following statement shows that there was a decided reduction in the number of scabby sheep received at the principal market centers during the year 1904, and while this was doubtless due in part to the restrictions under which infected sheep are shipped, it was also, no doubt, in some measure due to the gradual abatement of the disease in the Western States, where the work has been concentrated the past three or four years. It should also be borne in mind that these figures include scabby sheep that were dipped once and shipped to market for immediate slaughter, as provided by Bureau regulations, as all such receipts were reported from the receiving station as "infected."

Statement showing number of scabby sheep received at regular stations during the past five years.

Station.	1900.	1901.	1902.	1903.	1904.
Buffalo	1,846	1,647	1,170	3,177	4,729
Chicago	38,573	74,708	44,170	33,284	21,337
Cincinnati	2,189	5,518	2,624	3,426	1,004
Cleveland				634	304
Denver				1,301	6,677
Fort Worth				414	446
Indianapolis	174	600	342	964	1,262
Kansas City	49,089	38,109	17,030	11,288	8,260
Los Angeles					2,263

Statement showing number of scabby sheep received at regular stations during the past five years—Continued.

Station.	1900.	1901.	1902.	1903.	1904.
Louisville				135	
National Stock Yards	16,638	1,114	1,217	3,380	4,861
Philadelphia					227
Pittsburg		571		61	
Portland, Oreg	1,151	2,662	1,097	1,284	1,431
San Francisco					4,787
Seattle		447	3,009	7,957	1,100
Sioux City	286	2,034	1,599	734	385
South Omaha	52,026	28,896	32,785	27,954	13,012
South St. Joseph	12,125	5,806	4,324	13,204	9,926
South St. Paul	472	4,688	4,140	10,933	3,140
Wichita					70
Total	174,569	166,800	113,507	120,130	85,221

As will be seen from the following exhibits, there was a large increase over 1903 in the number of inspections and dippings in 1904, while the percentage of infection (7.42) among the sheep that were inspected was lower than in any previous year.

Comparative exhibit of inspections.

Year.	Total inspections.	Total infected sheep.	Percentage of infection.
1901	10,103,806	758,517	7.51
1902	15,327,766	1,366,007	8.91
1903	33,647,563	3,021,190	8.98
1904	43,179,878	3,203,599	7.42

Comparative exhibit of dippings.

Year.	Dippings of infected sheep.	Dippings of free and exposed sheep.	Total.	Redippings.	Total.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1900	127,521	806,910	934,431		934,431
1901	292,569	594,076	886,645		886,645
1902	880,847	959,461	1,840,308	275,921	2,116,229
1903	2,311,914	4,124,778	6,436,692	1,869,703	8,306,395
1904	2,443,016	7,627,191	10,070,207	2,023,682	12,093,889

The following comparative exhibit of the results of dipping shows the highest percentage of efficiency ever yet obtained, though the number reported upon is over 50 per cent larger than in 1903 and includes nearly one million infected sheep.

Comparative exhibit of the results of dipping.

[Compiled from letters received from owners of the sheep dipped.]

Year.	Whole number of dippings.	Number reported upon.	Per cent.	Number letters received.	Per cent— Effective.	Per cent— Ineffective.
1900	934,431	515,112	55.1	753	86	14
1901	886,645	356,359	40.2	536	91.8	8.2
1902	1,840,308	790,769	43	957	92	8
1903	6,436,692	3,950,161	61.4	3,558	98.5	1.5
1904	12,093,889	6,054,739	50.6	4,600	99.35	.65

In preparing the foregoing figures relative to the results of dipping, all cases reported to have shown infection in less than sixty days after the dipping were counted as ineffective, while those reported free of infection sixty days or longer were counted as effective, the assumption being that if the disease reappeared after two months it was because of later exposure.

In last year's report particular attention was called to the success obtained in Utah by the dipping of the previous season, and the prediction was made that the work done in Wyoming in 1903 would in 1904 show similar results. The following statement relating to the work done in Wyoming during the years 1903 and 1904 indicates that the prediction was well founded, while communications from State officials and from the inspector in charge of the work in that section are to the effect that at the close of 1904 the State was practically free from the disease:

Comparative statement of work done in Wyoming, 1903 and 1904.

	1903.	1904.		1903.	1904.
Total inspections	6,611,299	7,794,426	Total dippings	5,382,260	4,538,302
Number infected	2,090,484	1,230,634	Number reported upon.	2,460,711	2,207,152
Percentage of infection.	31.6	15.8	Percentage effective	99	99.98
Dippings of infected sheep.	3,385,987	1,630,700	Percentage ineffective	1	.02
Dippings of free and exposed sheep.	1,996,273	2,907,602			

The thoroughness of the work done in Wyoming and the splendid results obtained were largely due to the cooperation of State and Federal authorities. Inspectors of the Bureau of Animal Industry were also commissioned by the State and given all the authority of the State veterinarian, and with the aid of deputy State inspectors and the support of the State board of sheep commissioners all sheep in the infected localities were dipped according to the Bureau regulations.

While at the close of the season the State was doubtless comparatively free from the disease, yet in view of the probability that there were some owners who evaded the regulations by keeping their flocks in hiding, and that infected trails, bed grounds, and corrals may have retained the infection, it will likely be necessary to have a general dipping in 1905; but thereafter Wyoming should be a comparatively clean State and with reasonable vigilance on the part of the State authorities ought to remain so.

In New Mexico also the Bureau had a very good working arrangement with the Territorial authorities, and although the season was well advanced before its adoption much good work was accomplished before cold weather came on. An official order issued by the sheep sanitary board on August 23, 1904, gave notice to owners:

That all sheep within New Mexico having the disease of scabies must be dipped immediately and a second dipping given ten days after the first, and that sheep which do not have scab must be dipped at least once between now and October 20, 1904, but only when sheep are dipped under the supervision of an inspector will the dipping be recognized as a compliance with this order. * * * United States Government inspectors will supervise all dippings and only such dips or medicines as are approved by the Bureau of Animal Industry will be recognized.

It was agreed that Territorial inspectors should see the sheep owners and make all preliminary arrangements covering the time and place for dipping, while Bureau inspectors were to be present at the dipping stations and supervise the dipping of all sheep. Under this plan, as will be seen from the detailed summary on another page, over 4,000,000 dippings were accomplished. This, in connection with the work to be done there in 1905, will go far toward eradicating the disease from that Territory.

That the general results of the work of the Bureau have been satisfactory to the people most interested the following voluntary and unsolicited statements of large sheep owners will attest:

L. R. Van Houten, Buffalo, Wyo., says: "This section of country has been thoroughly cleaned of scabies by the Bureau of Animal Industry in the last two years. Its work has been very thorough, as I don't think one single case can be found at the present time in Johnson County."

John Findlay, Lander, Wyo., says: "There is not a case of scab in Fremont County that I know of, and it is my opinion that the good work should be kept up for another year at least before relaxing any of the regulations in regard to dipping."

A. J. Cunningham, president of the Casper National Bank, Casper, Wyo., says: "Your Department has accomplished something wonderful in this country. Last season we had 80 per cent of scabby sheep, and, to-day, not a case. We have in the county something like 150,000 sheep."

William Grieve, Oil City, Wyo., says: "I think your system has been the most successful that could have been put in force, and I, for one, am thankful for what has been done."

James Dickie, Embar, Wyo., says: "The work of the Government inspectors in Bighorn County for the year 1904 has been excellent, and the county is now practically clean and free from scab. Keep up the good work and scab will soon be a thing of the past."

E. J. Brandly, Granger, Wyo., says: "I take pleasure in attesting to the effective results due to the competent supervision of the Federal officers in handling the treatment of this scab infection here. A continuance for a year or two longer of this good work will no doubt stamp out the evil."

A. A. Covey, president of the Star Valley Live Stock Company, Afton, Wyo., says: "The results accomplished by the Federal inspectors in ridding our section of the range of scab can not be overestimated. Their work has been so thorough that present indications are that the flocks of western Wyoming will soon be entirely free from scab."

E. J. Bell, Laramie, Wyo., says: "Since I became familiar with the facts and the good intent on the part of the inspectors I feel that we have great protection, and if their work at other points is as thorough as it was here it is only a question of time until the sheep scab will be cleaned out; and every sheepman should feel grateful to the Government and their agents for this good work."

Louis C. Butscher, Raton, N. Mex., says: "It should be appreciated by every sheepman and cattleman in direct ratio to his holdings that our Government is taking such a direct interest in the health condition of live stock, and that it cooperates even to the extent of taking the initiative wherever necessary in applying all practicable health measures toward this end. Count upon me to the extent of my influence and ability for active help in any way you may be able to suggest or direct."

C. M. O'Donel, manager Red River Valley Company, Logan, N. Mex., says: "I am of opinion that the dipping of sheep under the supervision of the Bureau is a most useful work, and if continued will go far to eradicate scab from the New Mexico ranges. Further, that owing to the ignorance of a large percentage of the population such eradication can be effected in no other manner. I should like to see the Bureau of Animal Industry continue this work for two years more."

H. A. Scott, secretary of the Capitan Sheep Company, Richardson, N. Mex., says: "There is no doubt but that this part of the country is freer from scab than it has been for years."

Louis A. McRae, Willard, N. Mex., says: "From observations the Department's supervising of this matter has been very beneficial, and hope they will keep it up, with a better lookout that no herds escape dipping. This is a big country and needs lots of men to cover it."

D. B. Baca, Quemado, N. Mex., says: "It gives me pleasure to state (for the benefit of all wool growers) that I am entirely satisfied with the result of having dipped my sheep last October with lime-and-sulphur dip, and expect from all present indications that the yield of wool from the sheep dipped in that preparation will be at least 20 per cent more than the yield from the sheep I dipped in a commercial preparation. In addition, the quality of the wool is greatly improved in that it is so much softer and longer than that of my sheep dipped in the commercial dip. I make this entirely unsolicited statement in the hope that stockmen in general throughout our country may use lime and sulphur, which certainly merits every sheepman's attention."

M. S. Marriott, Ogden, Utah, says: "The dipping of sheep for scab under the present system is the best the country has ever had. I believe if the scab is ever eliminated from the United States it will be through the supervision now in vogue strictly carried out."

James Lindsay, Heber, Utah, says: "I am well pleased with the work done by the Bureau; it has proved a great blessing to the sheepmen of this locality. Should you continue in your good work scab in sheep will be a thing of the past."

The foregoing are only a few of the many commendatory expressions received from all parts of the country. They show that the woolgrowers realize the importance of drastic measures in dealing with the scab pest and are not only willing but anxious to do their part in its extermination.

The work of the year is shown in detail in the following statements:

Number of cars cleaned and disinfected in 1904 on account of scabies in sheep, 5,474.

Summary of inspections of sheep for scabies, January 1to December 31, 1904.

State or Territory.	Infected.	Exposed.	Free.	Total.
	Number.	*Number.*	*Number.*	*Number.*
Arizona	19,910	7,139	87,363	114,412
Arkansas			8,551	8,551
California	92,736	22,668	565,294	680,698
Colorado	182,882	166,514	2,488,571	2,837,967
Idaho	65,684	43,608	1,598,811	1,708,103
Illinois	61,119	210,539	6,930,920	7,202,578
Indiana	1,262		88,461	89,723
Indian Territory	1,130	687	4,020	5,837
Iowa	385	115	36,479	36,979
Kansas	22,595	6,771	160,358	189,724
Kentucky	990	7,776	275,197	283,963
Maine			23,939	23,939
Maryland		16,794	238,032	254,826
Massachusetts		89,718	97,019	186,737
Michigan			147	147
Minnesota	3,917	2,163	1,029,211	1,035,291
Missouri	18,186	273,943	1,491,581	1,783,710
Montana	2,385		1,370,651	1,373,036
Nebraska	51,514	83,069	4,483,779	4,618,362
Nevada	67,451	10,110	654,801	732,362
New Mexico	1,070,398	2,172,664	706,993	3,950,055
New York	4,836	1,901,545	666,350	2,572,731
North Carolina			5,760	5,760
North Dakota	1,737	23	215,118	216,878
Ohio	1,308	75,771	503,908	580,987
Oklahoma			8,757	8,757
Oregon	32,780	15,724	661,758	710,262
Pennsylvania	227	796,131	521,653	1,318,011
South Dakota	5,035		151,748	156,783
Tennessee			20,200	20,200
Texas	4,812	10,788	280,895	296,495
Utah	223,898	894,861	676,367	1,795,126
Virginia	70	2,313	20,359	22,742
Washington	34,000	7,400	368,036	409,436
Wisconsin	1,718	6,617	145,949	154,284
Wyoming	1,230,634	3,215,669	3,348,123	7,794,426
Total	3,203,599	10,041,120	29,935,159	43,179,878

Summary of dippings of sheep for scabies, January 1 to December 31, 1904.

State or Territory.	First dipping.				Second and third dippings.	Total dippings.
	Infected.	Exposed.	Free.	Total.		
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Arizona	17,750	5,319		23,069		23,069
California	70,592	8,750		79,342	38,810	118,152
Colorado	72,262	99,447	147,026	318,735	25,550	344,285
Idaho	37,628	40,108	12,900	90,636	27,529	118,165
Illinois	22,528	501,403	43,724	567,655	12,694	580,349
Indian Territory	1,130			1,130		1,130
Iowa	440		3,134	3,574		3,574
Kansas	7,766	1,328		9,094	1,895	10,989
Kentucky		1,231	581	1,812		1,812
Minnesota	1,219	122	23,020	24,361	117	24,478
Missouri	1,096	199,083	588	200,767	269	201,036
Montana	2,385			2,385		2,385
Nebraska	26,707	62,691	587,566	676,964	16,065	693,029
Nevada	51,037	19,832		70,869	31,617	102,486
New Mexico	1,051,439	2,158,952	9,240	3,219,631	829,456	4,049,087
New York	763	19,641		20,404	297	20,701
North Dakota	475	23	15	513	475	988
Ohio	417	13,154		13,571	38	13,609
Oregon	32,507	15,644		48,151	25,251	73,402
Pennsylvania	19			19		19
South Dakota	3,951		140	4,091	2,080	6,171
Texas	1,056	1,174		2,230	246	2,476
Utah	185,773	799,980	8,357	994,110	167,267	1,161,377
Washington	1,100			1,100		1,100
Wisconsin	1,718			1,718		1,718
Wyoming	851,258	2,734,940	108,078	3,694,276	844,026	4,538,302
Total	2,443,016	6,682,822	944,369	10,070,207	2,023,682	12,093,889

Statement showing the efficacy of dips used on sheep exposed to and infected with scab, January 1 to December 31, 1904.

[Compiled from 4,600 replies to circular letter of inquiry sent to owners.]

Where dipped.	Nicotine and sulphur.					Tobacco extract and sulphur.					Lime and sulphur.					Total.				Grand total number.
	Effective.		Ineffective.		Total number.	Effective.		Ineffective.		Total number.	Effective.		Ineffective.		Total number.	Effective.		Ineffective.		
	Number.	Per cent.	Number.	Per cent.		Number.	Per cent.	Number.	Per cent.		Number.	Per cent.	Number.	Per cent.		Number.	Per cent.	Number.	Per cent.	
Buffalo											10,613	100.00			10,613	10,613	100.00			10,613
Chicago						341,463	99.34	2,266	0.66	343,729						341,463	99.34	2,266	0.66	343,729
Cincinnati	*a 38*	*100.00*			*38*											*38*	*100.00*			
	6,677	100.00			6,677											6,677	100.00			6,715
Denver						2,211	100.00			2,211	45,889	100.00			45,889	48,100	100.00			48,100
Fort Worth											*211*	*100.00*			*211*	*211*	*100.00*			
											506	100.00			506	506	100.00			717
Kansas City											101,439	99.60	400	0.40	101,839	101,439	99.60	400	.40	101,839
Louisville						213	100.00			213						213	100.00			213
National Stock Yards, Ill	11,792	96.25	460	3.75	12,252						3,892	100.00			3,892	15,684	97.15	460	2.85	16,144
Portland, Oreg											293	100.00			293	293	100.00			293
Sioux City	12	100.00			12						907	100.00			907	919	100.00			919
South Omaha						382,563	99.71	1,119	.29	383,682						382,563	99.71	1,119	.29	383,682
South St. Joseph											42,415	100.00			42,415	42,415	100.00			42,415
South St. Paul											*119*	*100.00*			*119*	*119*	*100.00*			
						9,850	100.00			9,850	4,505	100.00			4,505	14,355	100.00			14,474
Arizona											*17,750*	*100.00*			*17,750*	*17,750*	*100.00*			
											2,319	100.00			2,319	2,319	100.00			20,069
California	*4,400*	*100.00*			*4,400*						*21,260*	*97.70*	*500*	*2.30*	*21,760*	*25,660*	*98.09*	*500*	*1.91*	
	1,800	100.00			1,800						845	100.00			845	2,645	100.00			28,805
Colorado						*3,100*	*100.00*			*3,100*	*17,777*	*82.81*	*3,689*	*17.19*	*21,466*	*20,877*	*84.98*	*3,689*	*15.02*	
						37,134	100.00			37,134	114,257	100.00			114,257	151,391	100.00			175,957
Idaho											*11,879*	*88.79*	*1,500*	*11.21*	*13,379*	*11,879*	*88.79*	*1,500*	*11.21*	
						13,152	100.00			13,152	20,590	100.00			20,590	33,742	100.00			47,121

Illinois (outside Chicago and National Stock Yards)						14,048	100.00			14,048						14,048	100.00			14,048
Kansas											1,328	100.00			1,328	1,328	100 00			1,328
Nebraska (outside South Omaha)											*11,592*	*100.00*			*11,592*	*11,592*	*100.00*			
						14,070	100.00			14,070	48,255	100.00			48,255	62,325	100.00			73,917
Nevada											*5,580*	*100.00*			*5,580*	*5,580*	*100.00*			
	8,000	100.00			8,000						4,600	100.00			4,600	12,600	100.00			18,180
New Mexico	*6,203*	*100.00*			*6,203*	*13,505*	*100.00*			*13,505*	*460,389*	*96.30*	*17,683*	*3.70*	*478,072*	*480,097*	*96.45*	*17,683*	*3.55*	
						97,481	100.00			97,481	1,196,016	99.52	5,730	.48	1,201,746	1,293,497	99.56	5,730	.44	1,797,007
Oregon											*15,037*	*100.00*			*15,037*	*15,037*	*100.00*			
						180	100.00			180	5,600	100.00			5,600	5,780	100.00			20,817
South Dakota			*2,080*	*100.00*	*2,080*						*1,427*	*100.00*			*1,427*	*1,427*	*40.69*	*2,080*	*59.31*	
											140	100.00			140	140	100.00			3,647
Utah											*112,780*	*99.16*	*952*	*.84*	*113,732*	*112,780*	*99.16*	*952*	*.84*	
	30,474	100.00			30,474	132,336	100.00			132,336	397,851	99.39	2,445	.61	400,296	560,661	99.57	2,445	.43	676,838
Wyoming	*49,299*	*100.00*			*49,299*						*204,332*	*99.76*	*500*	*.24*	*204,832*	*253,631*	*99.80*	*500*	*.20*	
	186,740	100.00			186,740	1,266,940	100.00			1,266,940	499,341	100.00			499,341	1,953,021	100.00			2,207,152
Total infected	*59,940*	*96.65*	*2,080*	*3.35*	*62,020*	*16,605*	*100.00*			*16,605*	*880,133*	*97.26*	*24,824*	*2.74*	*904,957*	*956,678*	*97.26*	*26,904*	*2.74*	*983,582*
Total exposed	245,495	99.81	460	.19	245,955	2,311,641	99.85	3,385	0.15	2,315,026	2,501,601	99.66	8,575	.34	2,510,176	5,058,737	99.76	12,420	.24	5,071,157
Grand total	305,435	99.18	2,540	.82	307,975	2,328,246	99.85	3,385	.15	2,331,631	3,381,734	99.02	33,399	.98	3,415,133	6,015,415	99.35	39,324	.65	6,054,739

[a] The figures in italic refer to infected sheep.

Comparative statement showing efficacy of dips used on sheep exposed to and infected with scabies during the calendar years 1903 and 1904.

Where dipped.	Year.	Nicotine and sulphur.				Extract of tobacco and sulphur.				Lime and sulphur.				Total.				Grand total.
		Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		Effective.		Ineffective.		
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Buffalo	1903									5,985	100.0			5,985	100.0			5,985
	1904									10,613	100.0			10,613	100.0			10,613
Chicago	1903					392,586	96.3	15,236	3.7					392,586	96.3	15,236	3.7	407,822
	1904					341,463	99.3	2,266	.7					341,463	99.3	2,266	.7	343,729
Cincinnati	1903	6,480	100.0											6,480	100.0			6,480
	1904	6,715	100.0											6,715	100.0			6,715
Denver	1903																	
	1904					2,211	100.0			45,889	100.0			48,100	100.0			48,100
Fort Worth	1903																	
	1904									717	100.0			717	100.0			717
Kansas City	1903									126,066	99.3	872	0.7	126,066	99.3	872	.7	126,938
	1904									101,439	99.6	400	.4	101,439	99.6	400	.4	101,839
Louisville	1903																	
	1904					213	100.0							213	100.0			213
National Stock Yards	1903	10,624	93.9	685	6.1									10,624	93.9	685	6.1	11,309
	1904	11,792	96.25	460	3.75					3,892	100.0			15,684	97.15	460	2.85	16,144
Portland, Oreg	1903																	
	1904									293	100.0			293	100.0			293
Sioux City	1903	974	100.0			127	100.0							1,101	100.0			1,101
	1904	12	100.0							907	100.0			919	100.0			919
South Omaha	1903	341	100.0			345,945	99.7	1,107	.3					346,286	99.7	1,107	.3	347,393
	1904					382,563	99.7	1,119	.3					382,563	99.7	1,119	.3	383,682
South St. Joseph	1903									32,262	98.9	357	1.1	32,262	98.9	357	1.1	32,619
	1904									42,415	100.0			42,415	100.0			42,415
South St. Paul	1903					3,193	100.0							3,193	100.0			3,193
	1904					9,850	100.0			4,624	100.0			14,474	100.0			14,474
Arizona	1903											2,475	100.0			2,475	100.0	2,475
	1904									20,069	100.0			20,069	100.0			20,069

California	1903	29,400	100.0			3,900	100.0			23,516	100.0			56,816	100.0			56,816
	1904	6,200	100.0							22,105	97.8	500	2.2	28,305	98.3	500	1.7	28,805
Colorado	1903					10,870	100.0			55,067	100.0			65,937	100.0			65,937
	1904					40,234	100.0			132,034	97.3	3,689	2.7	172,268	97.9	3,689	2.1	175,957
Idaho	1903									18,410	100.0			18,410	100.0			18,410
	1904					13,152	100.0			32,469	95.6	1,500	4.4	45,621	96.8	1,500	3.2	47,121
Illinois (outside Chicago and National Stock Yards)	1903					19,182	100.0							19,182	100.0			19,182
	1904					14,048	100.0							14,048	100.0			14,048
Kansas	1903									1,700	100.0			1,700	100.0			1,700
	1904									1,328	100.0			1,328	100.0			1,328
Minnesota (outside South St. Paul)	1903					10,010	89.0	1,232	11.0					10,010	89.0	1,232	11.0	11,242
	1904																	
Nebraska (outside South Omaha)	1903	27	100.0			16,413	100.0			18,293	100.0			34,733	100.0			34,733
	1904					14,070	100.0			59,847	100.0			73,917	100.0			73,917
Nevada	1903									14,071	100.0			14,071	100.0			14,071
	1904	8,000	100.0							10,180	100.0			18,180	100.0			18,180
New Mexico	1903					3,668	100.0			39,009	100.0			42,677	100.0			42,677
	1904	6,203	100.0			110,986	100.0			1,656,405	98.6	23,413	1.4	1,773,594	98.7	23,413	1.3	1,797,007
Oregon (outside Portland)	1903					3,713	100.0			16,920	100.0			20,633	100.0			20,633
	1904					180	100.0			20,637	100.0			20,817	100.0			20,817
South Dakota	1903																	
	1904			2,080	100.0					1,567	100.0			1,567	42.97	2,080	57.03	3,647
Texas (outside Fort Worth)	1903									2,200	100.0			2,200	100.0			2,200
	1904																	
Utah	1903	2,600	100.0			16,304	100.0			224,539	94.6	12,811	5.4	243,443	95.0	12,811	5.0	256,254
	1904	30,474	100.0			132,336	100.0			510,631	99.3	3,397	.7	673,441	99.5	3,397	.5	676,838
Wisconsin	1903					280	100.0							280	100.0			280
	1904																	
Wyoming	1903	107,500	97.7	2,544	2.3	1,346,868	98.8	16,796	1.2	980,517	99.3	6,486	.7	2,434,885	99.0	25,826	1.0	2,460,711
	1904	296,039	100.0			1,266,940	100.0			703,673	99.9	500	.1	2,206,652	99.98	500	.02	2,207,152
Total	1903	157,946	98.0	3,229	2.0	2,173,059	98.4	34,371	1.6	1,558,555	98.5	23,001	1.5	3,889,560	98.5	60,601	1.5	3,950,161
	1904	305,435	99.18	2,540	.82	2,328,246	99.85	3,385	.15	3,381,734	99.02	33,399	.98	6,015,415	99.35	39,324	.65	6,054,739

WORK AGAINST CATTLE SCAB.

For some years past inspectors of this Bureau have reported the presence of this disease among cattle in the West and have asked for instructions regarding it. It developed that, as with sheep, the best method of treatment was the dipping of the animals, and in order to meet the demands for information on the subject a bulletin describing the disease and outlining its treatment was issued in the early part of 1902. Liberal supplies of this bulletin were furnished to State authorities for distribution and numerous individual requests for it were promptly complied with, but the disease continued to spread rapidly, especially in the range country of the West, and in 1903 some of the State authorities, notably those of Colorado and North Dakota, became convinced that they must deal energetically with the subject, and called upon the Bureau for aid.

Accordingly, in June, 1903, regulations to prevent the spread of the disease were promulgated (B. A. I. Order No. 114). These regulations applied to that part of the United States west of the Mississippi River and the eastern boundary of Minnesota, and prohibited the interstate movement of infected cattle except for immediate slaughter. All available inspectors of the Bureau were at that time engaged in the work against sheep scab, so that the strict enforcement of these regulations was not practicable. The consequence was that the disease found its way from the western ranges to the feed lots of the Middle West, and threatened to injure the trade in live cattle for export. This spreading of the disease was caused by the infection of cars, pens, etc., the result of the nonenforcement of the regulations above referred to. It therefore became absolutely necessary to attack the trouble at its origin by prohibiting the shipment of infected cattle and applying the regulations to the entire United States.

With this end in view, new regulations were issued in March, 1904 (B. A. I. Order No. 123). This order permitted the interstate shipment of infected cattle for immediate slaughter after one dipping, and for stocking or feeding purposes after two dippings, while exposed cattle were permitted to be shipped for immediate slaughter without dipping, or for feeding or stocking purposes after one dipping.

The situation caused by the enforcement of this order created the urgent need of inspectors to pass upon cattle that were to be shipped from one State into another, and to meet this demand it was necessary to materially increase the force of inspectors located in the Western States.

These men, working in harmony with State officials and their deputies and in response to the demands made by owners, inspected and

permitted the marketing of millions of cattle under Bureau regulations. They likewise forbade the shipment of many that were not eligible to movement under the regulations above referred to.

The detailed summaries appended hereto show that employees of this Bureau made during the year 8,395,772 inspections, and supervised 564,863 dippings of cattle for scabies. It may also be added that 18,979 cars were cleaned and disinfected on account of this disease.

Statement showing number of scabby cattle received at regular stations in 1904.

[NOTE.—These figures include the receipts of infected cattle that were shipped for immediate slaughter after one dipping.]

Station.	Number.	Station.	Number.
Boston	123	National Stock Yards	352
Buffalo	142	Philadelphia	119
Cedar Rapids	48	Portland, Oreg	23
Chicago	1,359	St. Louis	327
Cleveland	19	South St. Paul	479
Denver	453	South St. Joseph	5,996
Des Moines	32	South Omaha	3,454
Fort Worth	283	Sioux City	1,519
Indianapolis	87	Total	19,702
Kansas City	4,864		
Louisville	23		

Summary of inspections of cattle for scabies, January 1 to December 31, 1904.

State or Territory.	Infected.	Exposed.	Free.	Total.
Arizona			11,350	11,350
California	360	70	51,568	51,998
Colorado	8,896	35,868	273,868	318,632
Georgia			53	53
Idaho			24,175	24,175
Illinois	1,291	528	2,312,576	2,314,395
Indiana			89,198	89,198
Iowa	1,568	117	278,081	279,766
Kansas	15,901	6,141	89,246	111,288
Kentucky	23	361	55,038	55,422
Maine			10,927	10,927
Maryland			91,049	91,049
Massachusetts			60,810	60,810
Michigan			174	174
Minnesota	479	252	283,452	284,183
Missouri	11,017	10,281	1,587,322	1,608,620
Montana	3,770	1,486	155,518	160,774
Nebraska	25,237	112,537	545,862	683,636
Nevada			15,925	15,925
New Jersey			24,350	24,350
New Mexico	5,351	736	129,557	135,644
New York	95	233	229,125	229,453
North Carolina			6,512	6,512

Summary of inspections of cattle for scabies, January 1 to December 31, 1904—Continued.

State or Territory.	Infected.	Exposed.	Free.	Total.
North Dakota	76,539	77,281	115,178	268,998
Ohio	19		88,258	88,277
Oklahoma	1,878		26,031	27,909
Oregon	5,915	3,469	40,758	50,142
Pennsylvania	119			119
South Carolina			990	990
South Dakota	55,948	44,391	268,861	369,200
Tennessee			29,142	29,142
Texas	14,365	11,141	755,336	780,842
Utah	70		15,635	15,705
Virginia			16,530	16,530
Washington	126		4,386	4,512
Wisconsin			22,572	22,572
Wyoming	1,765	31,540	119,195	152,500
Total	230,732	336,432	7,828,608	8,395,772

Summary of dippings of cattle for scabies, January 1 to December 31, 1904.

State or Territory.	First dipping.				Redippings.	Total dippings.
	Infected.	Exposed.	Free.	Total.		
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Colorado	1,032	2,887	287	4,206	830	5,036
Iowa	52	978	8,227	9,257	248	9,505
Kansas	2,952	1,137	159	4,248	1,021	5,269
Minnesota		2,197	3,352	5,549		5,549
Missouri	1,938	8,600	1,373	11,911	1,641	13,552
Montana	2,978			2,978	23	3,001
Nebraska	16,147	76,762	12,089	104,998	9,617	114,615
New Mexico	2,800	285		3,085	1,500	4,585
North Dakota	68,718	94,464	7,422	170,604	104,118	274,722
Oklahoma	249		36	285	3,706	3,991
Oregon	3,677	3,003		6,680	3,083	9,763
South Dakota	38,673	10,733	1,470	50,876	38,872	89,748
Texas	8,848	6,259	500	15,607	4,025	19,632
Utah		15		15		15
Wyoming	898	3,705	379	4,982	898	5,880
Total	148,962	211,025	35,294	395,281	169,582	564,863

CONTAGIOUS DISEASES OF ANIMALS IN FOREIGN COUNTRIES.

By John Roberts,
Editorial Clerk, Bureau of Animal Industry.

The status of contagious diseases of domestic animals for the past year in 10 foreign countries, derived from official reports, was as follows:

BELGIUM.

The Belgian authorities were quite successful in combating diseases of domestic animals during 1904. There was but 1 outbreak of foot-and-mouth disease, against 25 in 1903, and but 3 cases of foot-rot against 319. There was 1 outbreak only of sheep scab. Anthrax continues to be prevalent. In regard to tuberculosis, the intermittent monthly reports received each enumerate from 1,000 to 1,500 cases, all told.

Cases of contagious diseases of animals in Belgium during 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy	1	5	2	7	5	10
Rabies	4	1	4	1	1	3
Anthrax	29	48	61	46	48	34
Blackleg	11	14	10	13	20	19
Foot-rot	3	...	...	...	...	...

Name of disease.	July.	Aug.	Sept.	Oct.[a]	Nov.	Dec.	Total.[a]
Glanders and farcy	11	8	9	3	6	3	70
Foot-and-mouth disease	...	...	...	...	...	1	1
Rabies	3	...	...	...	4	4	25
Anthrax	41	62	69	29	59	69	595
Blackleg	24	44	36	20	25	26	262
Foot-rot	...	...	...	...	...	...	3
Sheep scab	...	...	...	...	57	...	57

[a] No report received for second half of October.

DENMARK.

The condition of the animal diseases in Denmark during the past year was very much improved in respect to the swine diseases as compared with 1903. There was, however, some increase in anthrax and cerebro-spinal fever, and, whereas no outbreaks of foot-and-mouth disease were reported in 1903, there were 19 in the ten months of 1904 shown below.

Outbreaks of contagious dieases of animals in Denmark in 1904.

Name of disease.	Jan.[a]	Feb.[a]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.[b]
Anthrax	......	......	18	16	16	1	9	12	9	21	35	35	172
Foot-and-mouth disease	......	......	10	......	4	......	5	......	......	......	......	......	19
Cerebro-spinal fever	......	......	3	2	1	......	4	1	3	4	2	6	26
Glanders and farcy	......	......	......	......	......	......	6	3	2	......	......	......	11
Malignant catarrhal fever	......	......	8	12	9	3	9	17	7	14	2	6	87
Swine plague	......	......	3	3	3	......	7	4	1	2	......	3	26
Rouget of swine:													
Acute	......	......	53	33	5	6	7	12	16	26	31	22	211
Chronic	......	......	18	3	......	......	......	......	......	......	......	......	21
Nodular	......	......	123	75	2	......	......	......	......	......	......	......	200

[a] No reports received for January and February.
[b] For ten months.

FRANCE.

Judging from the history of foot-and-mouth disease during recent years in France, it appears that the authorities have had much success in coping with this scourge, and now seem in a fair way to stamp it out altogether. There has been a very remarkable decrease in the number of outbreaks recorded of this disease since 1901. In the last-named year the number was 37,397; in 1902 it was 9,152; in 1903 it had fallen to 1,454, and last year the number reported was only 148. Rabies continues to be very prevalent, there being an average of 200 cases each month of the year, and the same state of affairs prevailed in 1903. There was no radical change in any of the other diseases as compared with the year before.

Status of contagious diseases of domestic animals in France in 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Pleuro-pneumonia:							
Number of outbreaks	1	-------	1	-------	-------	-------	-------
Number slaughtered	1	-------	2	-------	-------	-------	-------
Foot-and-mouth disease (outbreaks)	12	10	14	22	4	9	19
Sheep scab (outbreaks)	34	10	13	12	11	8	26
Sheep pox (outbreaks)	13	7	5	-------	6	36	30
Anthrax (outbreaks)	36	41	31	30	23	29	26
Blackleg (outbreaks)	67	50	50	35	50	49	57
Glanders and farcy:							
Number of outbreaks	40	35	42	51	65	78	38
Horses slaughtered	53	51	49	82	87	92	45
Rabies (cases)	154	149	203	203	249	302	230
Rouget (outbreaks)	28	31	21	24	29	43	64
Swine plague (outbreaks)	14	10	13	16	7	19	19

Name of disease.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Pleuro-pneumonia:						
Number of outbreaks	2	---------	---------	1	-------	4
Number slaughtered	5	---------	---------	2	-------	10
Foot-and-mouth disease (outbreaks)	23	6	8	17	4	148
Sheep scab (outbreaks)	4	6	6	9	30	169
Sheep pox (outbreaks)	4	1	2	4	3	111
Anthrax (outbreaks)	48	37	41	48	35	425
Blackleg (outbreaks)	78	70	118	119	104	847
Glanders and farcy:						
Number of outbreaks	29	29	40	35	31	513
Horses slaughtered	30	28	51	40	35	643
Rabies (cases)	176	201	182	168	176	2,393
Rouget (outbreaks)	121	51	29	25	25	491
Swine plague (outbreaks)	20	7	11	9	7	152

GERMAN EMPIRE.

Diseases of domestic animals in the German Empire were somewhat less prominent last year than in 1903. There was but one outbreak of pleuro-pneumonia, which existed until June; since then there has been no further evidence of this disease.

Number of localities and farms infected with diseases of domestic animals in Germany on the 1st day of each month in 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy:						
Localities	30	28	19	20	21	27
Farms	32	32	21	21	22	30
Pleuro-pneumonia:						
Localities	1	1	1	1	1	1
Farms	1	1	1	1	1	1
Foot-and-mouth disease:						
Localities	21	23	32	90	110	59
Farms	107	64	51	144	156	83
Swine plague:						
Localities	1,150	1,289	1,468	1,676	1,743	1,781
Farms	1,586	1,730	1,989	2,240	2,322	2,425

Number of localities and farms infected with diseases of domestic animals in Germany on the 1st day of each month in 1904—Continued.

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Glanders and farcy:						
Localities	19	37	37	34	42	41
Farms	22	51	52	47	54	51
Foot-and-mouth disease:						
Localities	50	44	72	95	123	125
Farms	68	73	204	331	278	181
Swine plague:						
Localities	1,670	1,563	1,527	1,459	1,438	1,406
Farms	2,254	2,116	2,103	2,002	1,975	1,999

GREAT BRITAIN.

The latest official report relating to the contagious diseases of animals in Great Britain is for the year 1903. The following information is from the board of agriculture and fisheries:

No case of cattle plague, pleuro-pneumonia, sheep pox, foot-and-mouth disease, or rabies has been recorded in 1903, while the outbreaks of swine fever have been materially reduced and stand at a figure lower than that of any previous year.

Sheep scab shows an increase as compared with 1902 of 169 cases. The number of outbreaks of swine fever was 1,478, as compared with 1,688 in 1902 and 3,140 in 1901. Regarding rabies, Dr. Alex. C. Cope, chief veterinary officer, says:

The last case of rabies confirmed in this country occurred in the month of December, in the year 1902, and, as diligent search has failed to discover any other, it is believed that the disease is now extinct in the United Kingdom.

There was an appreciable increase in the cases of glanders, as compared with 1902, and the question of issuing more stringent regulations for the suppression of this disease has been seriously considered. There was also an increase of 88 in the cases of anthrax.

Below is a table giving the number of outbreaks and cases of the various contagious diseases of animals in Great Britain annually since 1900. It should be borne in mind that Ireland is not included in this statement; the countries which comprise Great Britain are England, Scotland, and Wales.

Annual status of animal diseases in Great Britain since 1900.

Name of disease.	1900.	1901.	1902.	1903.
Rinderpest.[a]				
Foot-and-mouth disease:				
Outbreaks	21	12	1	....
Cases	266	669	120	....
Glanders and farcy:				
Outbreaks	1,119	1,347	1,155	1,456
Cases	1,858	2,370	2,040	2,499

[a] No outbreaks reported since 1877.

Annual status of animal diseases in Great Britain since 1900—Continued.

Name of disease.	1900.	1901.	1902.	1903.
Sheep scab:				
Outbreaks	1,939	1,537	1,664	1,833
Cases	26,610	22,674	21,523	24,431
Anthrax:				
Outbreaks	571	651	678	767
Cases	956	971	1,032	1,143
Rabies (cases)	6	1	13	....
Pleuro-pneumonia.[a]				
Swine fever:				
Outbreaks	1,940	3,140	1,688	1,478
Swine slaughtered	17,933	15,237	8,263	7,933

[a] No cases reported since 1898.

HUNGARY.

It will be seen from the status of the animal diseases in Hungary during the past year, the official figures of which are as below, that the only radical changes occurred in the swine diseases. Both rouget of swine and swine plague increased very largely in the latter part of the year. On the other hand, rabies and scab were less prevalent in December than in January. The figures in the table refer to the number of farms upon which the various diseases have broken out.

Number of premises infected with diseases of domestic animals in Hungary at monthly periods in 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	20	13	21	10	20	22
Rabies	57	57	84	101	86	86
Glanders and farcy	45	40	31	48	74	77
Foot-and-mouth disease	1,497	360	34	73	100	535
Sheep pox	35	32	35	30	17	14
Blisters upon genitals	12	5	12	89	174	362
Scab	228	384	697	1,072	1,438	1,241
Rouget	146	92	86	88	334	737
Swine plague	307	247	240	248	386	719

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Anthrax	11	12	88	54	31	31
Rabies	93	64	77	63	40	38
Glanders and farcey	74	59	48	35	38	29
Foot-and-mouth disease	1,132	1,958	2,455	2,017	1,403	1,045
Sheep pox	22	17	24	67	86	91
Blisters upon genitals	378	312	44	85	13	33
Scab	1,007	689	411	256	195	148
Rouget	1,448	1,931	1,652	1,431	1,435	1,113
Swine plague	1,200	1,543	1,367	1,301	1,129	899

ITALY.

Speaking generally, there was a very distinct falling off in the number of cases of animal diseases in Italy last year. The most prominent feature as compared with 1903 was the decrease in the number of cases of scab, which reached the enormous total of 754,702 in 1903, while that of last year was 44,731. There was, however, a remarkable increase in the total for anthrax, the respective figures being 874 in 1903 and 3,823 last year. The cases of foot-and-mouth disease decreased about 50 per cent, and those of glanders and farcy and agalassia about 70 per cent.

Number of cases of contagious diseases of animals in Italy during 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	327	207	138	132	161	546
Blackleg	21	17	19	14	20	30
Foot-and-mouth disease	436	781	281	28	64	30
Tuberculosis	52	49	50	66	54	34
Glanders and farcy	42	54	37	19	34	46
Sheep pox		33				
Rabies	49	20	79	29	34	17
Scab[a]	5,563	4,893	12,443	1,628	4,668	5,187
Maladie du coït				4		
Swine plague	653	673	983	1,071	1,529	1,664
Barbone of buffalo	18	6	1		17	
Agalassia contagiosa of sheep and goats	17	3,609	1,808	1,377	5,607	12,508

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	664	336	1,008	99	87	118	3,823
Blackleg	10	15	39	26	56	27	294
Foot-and-mouth disease	325	74	102	19	184	3,324	5,648
Tuberculosis	20	48	52	27	37	25	514
Glanders and farcy	52	38	30	22	40	45	459
Sheep pox							33
Rabies	9	18	38	17	10	9	329
Scab[a]	5,092	828	61	913	1,655	1,800	44,731
Maladie du coït							4
Swine plague	887	1,035	1,768	839	981	1,024	13,107
Barbone of buffalo	13		7	27	11		99
Agalassia contagiosa of sheep and goats	2,177	545	109	2,102	39		29,898

[a] Of the total of 44,731 cases of scab, 43,772 were of sheep and 959 of goats.

NETHERLANDS.

With the exception of anthrax there was a great diminution last year in the prevalent animal diseases of the Netherlands as compared with the previous year. Scab decreased from 2,887 to 869; rouget from 1,724 to 327, and foot rot of sheep from 738 to 511. It should be stated that the above totals are for eleven months in 1903, and ten months in 1904.

Cases of contagious diseases of domestic animals in the Netherlands during 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease				2		
Glanders and farcy			2	1	5	3
Scab	138	43	3	4	144	104
Foot rot of sheep	91	23	3	20	26	176
Rouget	7	5	4	9	18	73
Anthrax	69	39	82	59	29	24
Rabies					1	

Name of disease.	July.	Aug.[a]	Sept.[a]	Oct.	Nov.	Dec.	Total.[b]
Foot-and-mouth disease							2
Glanders and farcy	1			2	4		18
Scab	136			144	65	88	869
Foot rot of sheep	72				38	62	511
Rouget	95			47	31	38	327
Trichinosis of swine						1	1
Anthrax	17			43	46	48	456
Rabies							1

[a] No report received for August and September. [b] For ten months.

NORWAY.

The most prevalent cattle disease in Norway is anthrax. There were 614 cases of this disease during the past year, a total nearly equal to that of all the other diseases combined. Rouget, which was quite prevalent during the first three months of the year, has since then totally disappeared.

Cases of contagious diseases of animals in Norway reported in 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	40	33	64	63	58	90
Blackleg	2	3	2	2		9
Braxy of sheep	2	22	2	8	6	1
Malignant catarrhal fever	16	42	49	44	31	54
Rouget of swine	53	44	52			

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	34	52	36	42	45	57	614
Blackleg	3	6	4	6	12	4	53
Braxy of sheep			1	3	38	2	85
Malignant catarrhal fever	40	32	30	36	21	21	416
Rouget of swine							149

SWEDEN.

The number of outbreaks of contagious diseases of animals reported by the Swedish authorities during the past year are as below. A comparison of this report with that for the neighboring country—Norway—will show that although the Norwegian cattle are comparatively free from disease those of Sweden are still more so.

Outbreaks of contagious diseases of animals in Sweden during 1904.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	27	28	26	35	54	44	18	27	11	15	20	30	335
Blackleg	....	1	2	5	6	11	9	9	9	2	5	3	62
Swine plague	1	2	6	5	2	2	......	49	12	3	3	2	87

IMPORTS AND EXPORTS OF ANIMALS AND ANIMAL PRODUCTS.

By John Roberts,
Editorial Clerk, Bureau of Animal Industry.

The most prominent feature in our international trade in animals and animal products during the calendar year 1904 was the increase in the imports. The total value of these for the year was fully 10 per cent greater than in 1903, and compared with 1902 the increase was 20 per cent. Our total imports are, to be sure, little more than one-third the bulk of our exports, but since the import items are all comparatively small excepting two—wool and hides and skins—the facts just mentioned indicate considerable activity in the trades involved in these products and also show our inability to raise a sufficient quantity of these raw materials. The total annual values of these, as well as the other import items, are given in the comparative table of imports on page 472.

There were no changes of moment in the exports. The slight decrease in total value was chiefly due to the cheaper price of lard. This averaged 1½ cents less per pound than in 1903, and our trade in this commodity is so great that the drop in price made a difference of about $6,000,000 in the total receipts for the year, although the quantity involved was greater than in 1903 by close upon 28,000,000 pounds.

EXPORTS.

The total value of our domestic exports of animal products for 1904 was $249,307,614. This is a falling off of $5,997,011 compared with 1903. The table below shows, however, that the percentage to the total exports remains exactly the same as the year before, namely, 17.5, while the percentage to the total agricultural products took a sharp rise, going from 27.1 to 30.1. A glance at the respective totals for 1904 in the table will readily explain these percentages. It can be seen that the serious deficit occurs in the second column—that of all agricultural products—and inasmuch as the decrease in the total of the animal products is comparatively unimportant, it follows that

the deficit for the year was practically all in those agricultural products which were not animal products. The shortage was, in fact, caused by the enormous shrinkage in the output of wheat and corn. The exports of these two items declined, collectively, upward of 50 per cent compared with 1903, and the loss in the money received for them exceeded $100,000,000.

Total annual values of domestic exports, together with proportions of products of agriculture and of animal products, 1892–1904.

Year.	Total exports.	Exports of products of agriculture.[a]		Exports of animal products.		
		Total value.	Per cent of total exports.	Total value.	Per cent of agricultural exports.	Per cent of total exports.
1892	$923,237,315	$728,328,760	78.9	$222,666,575	30.6	24.1
1893	854,729,454	638,741,124	74.7	194,145,502	30.4	22.7
1894	807,312,116	593,840,797	73.6	212,754,589	35.8	26.4
1895	807,742,415	565,838,341	70.1	216,272,730	38.2	26.8
1896	986,830,080	686,294,050	69.5	213,263,615	31.1	21.6
1897	1,079,834,296	752,567,898	69.7	210,229,446	27.9	19.5
1898	1,233,558,140	877,726,585	71.2	233,450,480	26.6	18.9
1899	1,252,932,344	813,046,190	64.9	250,099,826	30.8	20.0
1900	1,453,010,112	934,972,097	64.3	264,316,945	28.3	18.2
1901	1,438,078,651	968,847,649	67.4	286,826,152	29.6	19.9
1902	1,333,268,491	848,816,260	63.6	244,886,259	28.8	18.4
1903	1,457,575,865	943,760,465	64.7	255,304,625	27.1	17.5
1904	1,425,748,138	828,114,681	58.0	249,307,614	30.1	17.5

[a] The following articles are included in this class, in addition to those enumerated by the Bureau of Statistics, Department of Commerce and Labor, namely: Coffee and cocoa, ground, etc.; distilled spirits; starch; refined sugar; leather, and a few unimportant items. The animal products are also included in this column.

The comparative statement of the exports for the past two years, which follows next, shows in detail the quantity and value of each item. It will be seen there was a net decrease in 1904 of about $6,000,000 in total value. The decrease in the principal item, lard, has already been referred to. The other items showing a falling off are fresh beef and canned beef, about $2,000,000 each, and salt pork, close upon $2,000,000. On the other hand, there was a substantial increase in the shipments of live cattle, the number advancing from 519,963 to 599,180 and the value from $37,725,452 to $41,415,729. Sole leather also advanced very materially. It will be noticed there are sharp differences in the respective totals of bacon and hams, but the combined totals are about the same for both years.

Quantities and values of animals and animal products exported from the United States in the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Articles.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle .... number..	519,963	$37,725,452	599,180	$41,415,729
Hogs .... do....	5,823	53,180	5,549	56,784
Horses .... do....	39,367	3,142,731	40,609	3,255,005
Mules .... do....	3,101	354,776	4,784	502,142
Sheep .... do....	189,872	1,153,770	338,306	2,173,698
All other, including fowls	....	121,265	....	144,494
Bones, hoofs, horns, etc	....	178,392	....	189,827
Dairy products:				
Butter .... pounds..	9,345,416	1,600,323	13,880,287	2,184,082
Cheese .... do....	19,634,239	2,302,118	19,128,902	1,928,639
Milk	....	1,018,063	....	1,849,513
Eggs .... dozens..	1,456,342	316,211	2,345,558	516,263
Feathers	....	129,960	....	205,594
Glue .... pounds..	2,710,203	265,799	2,567,480	253,189
Grease, and other soap stock	....	3,495,418	....	3,283,675
Hair, and manufactures of	....	680,832	....	745,240
Hides and skins (other than furs) . pounds..	21,251,307	2,078,414	24,514,226	2,430,894
Lard oil .... gallons..	327,944	251,963	332,253	200,577
Other animal oil .... do....	202,691	148,712	626,166	344,961
Leather:				
Sole leather .... pounds..	33,501,774	6,320,663	43,870,238	8,685,190
Upper leather	....	16,343,309	....	16,550,948
Other leather	....	1,033,437	....	1,474,256
Meat products:				
Beef—				
Canned .... pounds..	66,738,931	6,850,079	52,158,326	5,177,926
Fresh .... do....	293,401,843	26,692,858	262,328,700	24,142,308
Salted, pickled, and cured .... do....	58,154,546	3,703,177	54,611,813	2,959,886
Tallow .... do....	63,537,840	3,320,080	62,708,783	3,012,897
Bacon .... do....	213,519,817	21,800,532	252,515,667	24,865,126
Hams .... do....	205,494,949	24,383,662	188,284,123	20,576,889
Pork—				
Canned .... do....	10,817,461	1,127,495	10,516,238	1,037,537
Fresh .... do....	20,900,694	1,962,557	14,896,636	1,292,854
Salted and pickled .... do....	107,082,084	10,367,223	106,473,494	8,542,188
Lard .... do....	535,375,757	50,224,669	563,520,159	44,304,628
Lard compounds and substitutes . do....	52,984,214	3,920,268	53,147,716	3,375,018
Mutton .... do....	2,780,265	253,384	599,902	47,091
Poultry and game	....	1,138,816	....	1,075,940
Sausage and sausage meat ..... pounds..	5,262,081	586,384	5,874,715	640,168
Sausage casings	....	2,220,126	....	2,606,879
All other meat products	....	4,215,131	....	3,934,934
Oleo oil .... pounds..	152,100,830	13,032,189	160,549,112	12,609,895
Oleomargarine .... do....	7,391,199	747,860	7,304,434	693,751
Wool, raw .... do....	383,965	43,347	183,851	20,993
Total	....	255,304,625	....	249,307,614

IMPORTS.

The imports of animal products for 1904, as shown in the tabular statement below, reached a total value of $111,743,568; which is an increase of $10,736,025 over the previous year. A perusal of the totals for the four years shown in the table reveals a remarkably uniform rate of increase from year to year. About four-fifths of the entire imports are taken up with two items—hides and skins and wool. The demand for the former has been fairly uniform for the past four years, but the importations of wool have increased by bounds, the total for 1904 being more than double that of 1901.

Table showing the value of animals and animal products imported into the United States for the calendar years 1901–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article imported.	1901.	1902.	1903.	1904.
Cattle	$1,626,964	$1,218,412	$553,029	$208,891
For breeding	315,641	350,901	91,740	102,372
Horses	296,933	303,975	386,289	394,165
For breeding	969,776	1,441,893	1,086,131	950,829
Sheep	940,325	1,006,186	831,587	631,613
For breeding	49,974	43,045	21,826	41,156
All other animals, including fowls	119,304	314,150	381,668	191,885
For breeding	260,671	308,795	332,819	410,640
Bones, hoofs, horns, etc	670,171	701,133	548,385	747,633
Bone and horn manufactures	220,820	235,366	268,410	216,538
Bristles	1,666,747	2,458,481	2,496,492	2,567,069
Dairy products:				
Butter	28,759	95,571	39,399	47,054
Cheese	2,335,829	2,862,677	3,252,653	3,247,931
Milk	36,897	24,459	60,705	21,040
Eggs	12,041	52,547	21,850	62,599
Feathers, crude	2,001,498	1,916,125	2,888,061	2,255,386
Glue	449,769	559,415	596,426	651,030
Grease and oils	888,018	1,038,611	847,929	1,387,257
Hair	1,796,138	2,383,327	2,505,612	3,007,071
Hides and skins (other than furs):				
Goatskins	25,265,670	24,171,569	23,441,687	25,962,620
Hides of cattle	16,001,902	16,871,656	13,489,077	11,969,720
All other	14,297,816	16,689,172	16,350,180	19,685,809
Hide cuttings and other glue stock	826,206	786,396	750,798	988,755
Leather:				
Sole leather, calfskins, etc	176,258	607,734	955,837	728,274
Skins for morocco	2,399,603	2,037,556	2,030,389	2,136,824
Upper leather	2,931,516	2,406,071	2,150,179	2,196,867
Meat products	474,232	1,513,705	897,396	778,995
Sausage casings	583,495	918,031	919,255	798,201
Wool	14,017,432	19,590,227	22,811,734	29,355,344
Total	91,660,405	102,907,186	101,007,543	111,743,568

IMPORTS AND EXPORTS OF FARM ANIMALS.

CATTLE.

The table of imports and exports of farm animals on the next page shows a decided falling off in the imports of cattle last year; it will be seen there has been a pronounced decrease each year since 1901. Nearly all the imports of cattle are cheap animals brought over the Mexican and Canadian borders for feeding. Of the 15,877 cattle imported last year 2,203 were for breeding purposes. The average price per head of the latter, as shown below, indicates they were of a much lower grade than in previous years.

There was a very satisfactory increase in the exports last year, but the average price obtained for them fell $3.38 per head. Practically all these exports are fat cattle for the British market.

Average price per head of imports and exports of cattle, 1901–1904.

Year.	Imports.		Exports.
	Cattle for breeding.	Other cattle.	
1901	$221.50	$12.12	$80.50
1902	165.50	13.34	74.25
1903	132.25	14.06	72.50
1904	46.47	15.28	69.12

HOGS.

There is little foreign trade in live hogs. The imports are not separately enumerated, and the exports, which it will be seen by the table averaged only about 5,000 for the past three years, mostly went over the Mexican and Canadian borders.

SHEEP.

Imports of sheep, like those of the other farm animals, are divided into two classes—those for breeding, which are admitted free of duty, and all others, which pay a duty. Of the latter class there were 178,412 brought in last year, a decrease of about 70,000 compared with 1903. The breeding animals numbered 1,977 in 1904 as against 1,106 in 1903, and the average price was slightly higher last year.

Although the exports in 1904 nearly doubled those of 1903, it is satisfactory to note a higher average price than for any other year in the table.

Average price per head of imports and exports of sheep, 1901–1904.

Year.	Imports.		Exports.
	Sheep for breeding.	Other sheep.	
1901	$23.08	$3.56	$5.82
1902	21.25	3.32	6.34
1903	19.73	3.36	6.08
1904	20.82	3.54	6.42

HORSES AND MULES.

The import and export trade in horses in 1904 was quite normal in character, both in respect to quantity and value. The two classes of imports—horses for breeding and working horses—are about equally divided as regards number. It will be noticed the exports, the majority of which go across the border to Canada, greatly outnumber the imports.

The average annual prices were as follows:

Average price per head of imports and exports of horses, 1901–1904.

Year.	Imports.		Exports.
	Horses for breeding.	Working horses.	
1901	$395.50	$152.25	$100.50
1902	437.75	155.50	100.25
1903	412.75	176.00	79.85
1904	393.23	181.89	80.15

No imports of mules are enumerated. There was a considerable increase in the exports compared with 1903.

The tables below give, first, the imports and exports of the different farm animals annually from 1896 to 1904, and second, the exports of the same for 1904, by countries.

Number and value of imports and exports of farm animals for the years 1896–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Year.	Cattle.		Hogs.		Sheep.		Horses.		Mules.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
IMPORTS.										
1896	141,653	$988,677			382,443	$1,013,481	8,252	$509,819		
1897	403,717	3,581,643			414,455	1,145,922	5,993	505,838		
1898	261,826	2,730,882			360,820	1,187,210	2,718	321,835		
1899	186,596	2,235,383			361,731	1,305,063	3,215	581,928		
1900	142,055	1,871,546			345,985	1,260,132	3,541	886,811		
1901	135,694	1,942,605			265,952	990,299	4,402	1,266,709		
1902	93,481	1,569,313			304,755	1,049,231	5,248	1,745,868		
1903	40,027	644,769			248,382	853,413	4,827	1,472,420		
1904	15,877	311,263			180,389	672,769	4,585	1,344,994		
EXPORTS.										
1896	394,772	36,576,412	33,785	$367,917	323,576	1,948,841	28,632	3,601,137	6,534	$475,106
1897	447,469	39,379,532	16,841	150,814	218,427	1,331,712	45,642	5,617,265	7,753	631,904
1898	397,879	33,463,267	16,879	117,546	176,498	1,070,966	48,917	6,010,773	6,996	514,569
1899	409,176	30,685,461	52,230	363,609	150,824	861,337	49,983	5,747,468	20,228	1,702,099
1900	423,181	33,819,164	33,915	313,836	148,391	900,734	79,520	9,102,432	50,179	4,757,892
1901	454,590	36,606,204	15,909	169,097	432,419	2,514,766	99,809	10,037,204	25,053	2,267,262
1902	327,118	24,301,969	4,582	47,186	235,497	1,492,484	60,694	6,086,012	16,306	1,744,192
1903	519,963	37,725,452	5,823	53,180	189,872	1,153,770	39,367	3,142,731	3,101	354,776
1904	599,180	41,415,729	5,549	56,784	338,306	2,173,698	40,609	3,255,145	4,784	502,142

Number and value of exports of farm animals for the calendar year 1904 and countries to which exported.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Country to which exported.	Number.	Value.
Cattle:		
United Kingdom	388,185	$36,268,953
Belgium	11,008	1,031,391
British North America	27,756	834,453
Central American States and British Honduras	86	3,801
Mexico	7,409	384,544
West Indies and Bermuda	163,249	2,776,501
South America	1,041	73,071
Asia and Oceania	32	5,110
Other countries	414	37,900
Total	599,180	41,415,729
Hogs:		
British North America	1,107	9,020
Mexico	2,492	27,819
West Indies and Bermuda	1,872	17,236
South America	33	992
Asia and Oceania	16	1,324
Other countries	29	393
Total	5,549	56,784
Sheep:		
United Kingdom	248,283	1,791,842
Belgium	7,710	59,467
British North America	68,581	210,041
Mexico	3,837	43,762
West Indies and Bermuda	5,081	35,924
South America	543	4,620
Other countries	4,271	28,042
Total	338,306	2,173,698
Horses:		
United Kingdom	2,301	503,150
Belgium	175	26,110
France	2	1,000
Germany	126	33,550
British North America	20,130	1,925,539
Central American States and British Honduras	35	6,915
Mexico	2,231	196,141
West Indies and Bermuda	15,425	533,960
South America	27	6,905
Other Asia and Oceania	43	11,345
British Africa	114	10,390
Total	40,609	3,255,005
Mules	4,784	502,142
All other animals, including fowls		144,494
Total animals		47,547,852

EXPORTS OF ANIMAL PRODUCTS TO THE UNITED KINGDOM.

It is very well known that Great Britain is the chief customer for our surplus products, and this is true of the animal products as well as the others. A comparison of the total of the table below with the total value of our exports on page 471 will show that the British consume considerably more than one-half of all the animal products that enter into our foreign trade. It will be seen that the total volume of the trade for the past two years footed up singularly even; there were, however, some noteworthy variations in the items. Live animals increased about $5,000,000, mostly at the expense of dead meat. There was a slight gain in the aggregate of hams and bacon, and butter advanced materially. A drop of nearly 2 cents per pound in the average price of the lard caused a shrinkage of over $2,000,000 in the total of that article, although a considerably increased quantity was taken. Our exports of animal products to the United Kingdom for 1903 and 1904, by articles, were as follows:

Quantity and value of animals and animal products purchased by the United Kingdom from the United States in the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle .... number..	342,745	$32,443,133	388,185	$36,268,958
Horses .... do....	2,929	495,630	2,301	503,150
Sheep .... do....	117,357	856,921	248,283	1,791,842
Hides and skins, other than furs..pounds..	3,298,943	321,218	2,803,081	287,851
Leather:				
Sole leather .... do....	27,914,399	5,098,254	30,597,069	5,622,475
Upper leather .... do....	....	11,072,694	....	11,097,975
Meat products:				
Beef, canned .... do....	48,822,078	5,011,789	36,398,244	3,666,810
Beef, fresh .... do....	291,790,863	26,544,184	260,875,769	24,017,354
Beef, salted and cured .... do....	20,654,633	1,395,339	16,295,123	904,370
Tallow .... do....	23,214,137	1,170,902	33,840,483	1,589,933
Bacon .... do....	163,894,472	16,892,518	208,901,184	20,964,520
Hams .... do....	177,745,090	21,193,635	168,061,786	18,354,844
Pork, salted and fresh .... do....	71,432,291	7,215,877	74,639,498	6,324,665
Lard .... do....	198,456,816	18,812,984	214,119,382	16,591,818
Oleo oil, etc .... do....	6,602,645	563,866	9,849,180	763,474
Dairy products:				
Butter .... do....	4,020,418	676,328	8,018,071	1,211,119
Cheese .... do....	17,855,068	2,052,206	17,159,811	1,675,482
Total	....	151,817,478	....	151,636,640

IMPORTS OF ANIMAL PRODUCTS INTO THE UNITED KINGDOM.

It may be interesting to show the total imports of animal products into the United Kingdom, from all sources, together with the respective amounts contributed from the chief sources on the American continent. A perusal of the several items in the annexed table indicates that notwithstanding the liberal proportions contributed by the United States in a number of the articles, there are several, as, for instance, fresh pork, bacon, the dairy products, etc., where we should reasonably look for an increase. The imports mentioned are those which enter into home consumption only.

Imports of animals and animal products into the United Kingdom in 1904.

Articles.	Quantity.	Value.	Amount contributed by—		
			United States.	Canada.	Argentina.
Cattle .... number	549,532	$47,382,366	$34,844,442	$12,397,180	....
Sheep and lambs .... do	382,240	2,880,890	2,222,190	607,334	....
Horses .... do	18,491	2,228,020	456,001	80,497	....
Beef:					
Fresh .... pounds	489,140,064	39,322,571	24,966,537	....	$12,082,079
Salt .... do	16,162,048	911,437	842,381	....	....
Mutton, fresh [a] .... do	391,415,584	33,391,641	....	....	12,123,473
Pork:					
Fresh .... do	68,274,320	6,708,310	1,277,213	....	....
Salt .... do	27,310,304	1,401,140	581,172	....	....
Bacon [b] .... do	610,658,832	62,447,619	30,216,142	9,076,796	....
Hams .... do	139,329,456	15,110,478	12,682,727	2,362,817	....
Rabbits, dead .... do	59,774,176	3,799,457	....	....	....
Poultry and game .... do	....	5,923,387	1,072,645	....	....
Meat, preserved .... do	91,212,576	11,980,549	(c)	(c)	(c)
All other meat .... do	70,673,344	5,664,664	1,025,002	....	....
Cheese .... do	286,081,376	28,438,721	2,449,368	20,608,606	....
Butter [d] .... do	474,992,560	102,766,669	1,433,593	5,814,606	....
Milk, condensed .... do	89,137,376	7,823,609	(c)	(c)	(c)
Eggs .... dozens	199,425,940	32,754,338	....	630,849	....
Lard .... pounds	205,053,744	16,265,765	14,803,144	....	....
Margarine .... do	107,551,136	12,139,324	....	....	....
Tallow and stearin .... do	196,904,288	10,946,924	2,002,643	....	2,297,840
Wool, sheep's .... do	561,706,689	99,115,665	....	....	1,965,239
Alpaca, vicuña and llama, pounds	5,052,501	1,357,719	....	....	....
Camel's hair .... pounds	5,314,798	720,125	(c)	(c)	(c)
Mohair .... do	25,589,517	7,916,501	....	....	....
Other goats' hair .... do	4,012,652	377,855	(c)	(c)	(c)
Shoddy, etc .... do	90,774,140	3,715,339	(c)	(c)	(c)
Woolen yarn .... do	24,473,058	11,448,354	(c)	(c)	(c)
Hides, raw:					
Dry .... do	36,430,016	4,577,459	....	....	....
Wet .... do	50,3c8,000	5,384,558	....	....	254,362

[a] The largest contributor of mutton is New Zealand. The amount in 1904 from this colony was 192,212,000 pounds; value, $16,502,423.
[b] After United States the next largest contributor was Denmark, with 193,075,000 pounds; value, $22,057,022.
[c] Countries of origin not stated.
[d] Denmark sends by far the largest amount of butter of any single country; the amount in 1904 was 191,365,328 pounds; valued at $43,813,533.

Imports of animals and animal products into the United Kingdom in 1904—Continued.

Articles.	Quantity.	Value.	Amount contributed by—		
			United States.	Canada.	Argentina.
Skins, undressed:					
Goat .... number..	12,807,240	$5,925,684	....	....	....
Sheep .... do....	15,081,814	7,676,427	....	....	$1,314,057
Leather .... pounds..	128,972,816	39,115,540	$17,143,760	....	....
Bristles .... do....	4,569,852	2,982,508	(a)	(a)	(a)
Bone manure .... do....	78,630,720	746,487	(a)	(a)	(a)
Glue, etc .... do....	25,472,058	2,221,582	(a)	(a)	(a)
Total	....	643,569,682	148,018,960	$51,578,685	30,037,050
Total for 1903	....	660,952,170	150,545,582	56,371,590	33,205,896

a Countries of origin not stated.

IMPORTS OF MEAT INTO THE UNITED KINGDOM.

The several tabular statements which follow, referring to the details of the British meat trade, are taken from the London (England) Live Stock Journal, the quantities having been changed from "hundredweights" to pounds, and the values converted from the English to the United States equivalents. The first table shows the total consumption of foreign meat in Great Britain, annually, since 1890.

The quantities in the second column of the table, giving the dead weight of the live meat, are got by allowing an average dressed weight for cattle of 90 stone (720 pounds), for calves 16 stone (128 pounds), and for sheep 7½ stone (60 pounds).

Estimated annual totals of meat imported into United Kingdom since 1890.

Year.	Dead meat.	Dead weight of live meat.	Total meat.
	Pounds.	*Pounds.*	*Pounds.*
1890	1,127,642,768	452,368,000	1,580,010,768
1891	1,108,116,240	362,820,864	1,470,937,104
1892	1,188,059,264	366,239,776	1,554,299,040
1893	1,053,750,544	248,815,728	1,302,566,272
1894	1,200,513,440	371,314,720	1,571,828,160
1895	1,354,944,192	362,966,352	1,717,910,544
1896	1,514,026,640	451,092,656	1,965,119,296
1897	1,680,579,712	481,719,840	2,162,299,552
1898	1,841,873,040	449,444,576	2,291,317,616
1899	1,921,750,880	398,818,896	2,320,569,776
1900	2,006,114,656	379,328,432	2,385,443,088
1901	2,101,616,272	379,697,136	2,481,313,408
1902	1,900,754,464	319,474,736	2,220,229,200
1903	1,959,790,560	397,443,872	2,357,234,432
1904	1,964,050,704	418,402,656	2,382,453,360

THE LONDON CATTLE MARKETS.

Below are the monthly arrivals of home and foreign cattle at the London marts for 1904. It should be stated that the totals in the

British column include, besides fat cattle, butchering cows, bulls, and rough cattle, as well as Irish store cattle. There were no shipments of live stock from Argentina last year, the bars having been up against that country since June, 1903, on account of foot-and-mouth disease.

Arrivals of British and foreign cattle in London in 1904.

Month.	British.	United States.	Canadian.	Argentine.
January	4,950	12,445	422	
February	5,800	14,925	389	
March	4,600	15,639	195	
April	4,045	12,962		
May	5,300	12,753	741	
June	4,150	14,968	3,287	
July	5,550	10,519	2,094	
August	5,430	8,462	5,380	
September	5,330	10,917	2,393	
October	7,210	9,382	5,281	
November	5,920	11,104	3,589	
December	5,215	9,127	1,458	
Total, 1904	63,500	143,203	25,229	
Total, 1903	68,210	141,686	25,251	20,397
Total, 1902	81,960	108,139	34,629	

The range of the average monthly top rates of the above cattle for the year was as follows, the amounts being for 100 pounds, dressed weight: British, \$12.67 to \$15.71; United States, \$10.39 to \$14.45; Canadian, \$10.14 to \$13.94.

The effect of the foreign trade upon the home supply may be seen from the following statement, giving the total number of the British cattle offered for sale at the London market annually since 1881, together with the top rate. It will be noticed that the top prices have been fairly uniform for twenty years.

Annual arrivals of British cattle in London since 1880.

Year.	Number.	Top rate.	Year.	Number.	Top rate.
1880	202,860	\$19.20	1893	110,250	\$15.66
1881	188,870	19.20	1894	99,020	14.65
1882	174,480	19.20	1895	99,660	16.17
1883	150,440	19.20	1896	78,930	15.66
1884	157,820	18.69	1897	78,580	15.16
1885	182,000	17.68	1898	76,745	14.65
1886	209,340	16.17	1899	83,586	15.66
1887	223,600	16.17	1900	78,490	15.16
1888	175,950	16.17	1901	71,320	16.17
1889	154,370	16.17	1902	81,960	
1890	132,380	15.66	1903	68,210	15.66
1891	115,040	16.67	1904	63,500	15.71
1892	88,371	16.17			

THE LONDON SHEEP TRADE.

The monthly arrivals of British and foreign sheep and lambs for 1904 were as follows:

Arrivals of British and foreign sheep and lambs in London in 1904.

Month.	British.	United States.	Canadian.	Argentine.
January	36,850	1,049	1,962	
February	46,820	4,308	1,653	
March	40,540	9,713		
April	45,720	6,361		
May	55,820	5,786		
June	49,080	2,608	508	
July	46,120	690	2,440	
August	45,180	3,331	1,040	
September	33,400	420	4,010	
October	35,350		5,955	
November	28,670		5,586	
December	25,335	2,184	3,956	
Total, 1904	488,885	36,450	27,113	
Total, 1903	493,690	8,635	41,957	66,095
Total, 1902	481,980	38,765	41,050	

The range of the monthly top rates of the above for last year—per 100 pounds dressed weight—was as follows:

	Sheep.	Lambs.
British	\$17.24–\$18.76	\$17.74–\$24.84
United States	12.67– 15.74	12.67– 17.24
Canadian	12.17– 14.19	15.21– 16.22

The total annual arrivals of British sheep and lambs in the London market since 1880 are given in the table below, together with the top rates per 100 pounds dressed weight.

Annual arrivals of British sheep and lambs in London since 1880.

Year.	Number.	Top rate.	Year.	Number.	Top rate.
1880	872,910	\$21.72	1893	877,810	\$18.19
1881	726,590	22.23	1894	835,160	19.20
1882	561,600	24.25	1895	746,580	19.70
1883	587,590	24.76	1896	644,730	20.21
1884	603,220	22.23	1897	594,590	18.69
1885	742,740	19.70	1898	538,180	17.68
1886	748,820	20.21	1899	547,090	18.69
1887	773,120	19.70	1900	498,130	19.20
1888	698,380	19.70	1901	516,580	18.69
1889	746,140	20.71	1902		
1890	676,890	21.22	1903	493,690	19.20
1891	772,590	18.69	1904	488,885	18.25
1892	755,620	18.19			

EXPORTS OF ANIMAL PRODUCTS TO GERMANY.

The status of our trade in animal products with the German Empire and the relation it bears to the entire import trade of that country may be seen from the two statements below. The first of these shows our exports to Germany for the past two years, and the second gives the total imports into that country from all sources, annually, for the last three years.

The first table shows that our trade fell off quite appreciably in 1904. It will be seen the total value fell from $23,774,953 to $19,220,174, which is a decrease of $4,554,779, or nearly 20 per cent. The individual items show a general decline, with a few exceptions, of which two may be noted, namely, an increase of close upon $200,000 in upper leather, and a big advance in the dairy products, but the latter trade is unimportant.

Over two-thirds of our entire trade with Germany is taken up with one item—lard—for which the Germans are largely dependent upon us for their supply. There was but a slight decrease in the quantity of this product sent over last year as compared with 1903, but as lard was much cheaper there was a big fall in the total value. The average prices per pound of the exports of this item to Germany since 1901 were as follows: 1901, 8.52 cents; 1902, 10.05 cents; 1903, 9.45 cents; 1904, 7.95 cents.

Quantity and value of animals and animal products purchased by Germany from the United States in 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Albumin and casein [a] ... pounds	653,223		766,100	
Bones, horns, and hoofs [a] ... do	4,961,232		6,008,900	
Bristles [a] ... do	100,530		93,300	
Dairy products:				
Butter ... do	481,054	$74,344	778,374	$116,533
Cheese ... do	5,800	804	28,198	2,917
Bedfeathers [a] ... do	54,674		80,000	
Hides and skins (other than furs) ... do	5,708,367	460,079	5,293,092	482,032
Horsehair [a] ... do	82,672			
Horses ... number	185	27,853	126	33,500
Leather:				
Sole ... pounds	82,315	16,073	18,112	3,684
Upper and other		803,536		991,137
Meats and meat products:				
Beef, canned ... pounds	1,172,294	117,920	1,221,900	119,850
Beef, salted, etc ... do	8,922,471	575,088	6,976,156	406,950
Pork ... do	3,130,886	289,903	2,275,558	189,428
Bacon ... do	15,260,392	1,426,046	6,423,847	561,343
Hams ... do	892,543	91,518	208,867	22,059
Lard ... do	174,877,447	16,525,877	172,337,675	13,704,402

[a] Taken from German official returns, which give quantities but not values.

Quantity and value of animals and animal products purchased by Germany from the United States in 1903 and 1904—Continued.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Meats and meat products—Continued.				
Tallow ... pounds..	10,647,290	$546,687	7,187,736	$355,594
Stearin, etc.[a] ... do	16,161,482	....	15,497,900	....
Oleo oil, etc ... do	31,884,775	2,819,220	28,015,125	2,230,745
Other animal fat[a] ... do	3,475,331	....	5,583,400	....
Sausage casings[a] ... do	17,798,397	....	19,242,600	....
Wool, raw[a] ... do	171,959	....	....	....
Total ...	....	23,774,953	....	19,220,174

[a] Taken from German official returns, which give quantities but not values.

The total imports of animal products into Germany for home consumption for the years 1902, 1903, and 1904 were as below:

Value of animals and animal products imported into Germany during the calendar years 1902, 1903, and 1904.

[Compiled from Auswärtiger Handel des Deutschen Zollgebiets, published by the German Government.]

Article imported.	1902.	1903.	1904.
Bones, horns, etc ...	$1,694,300	$1,617,900	$1,628,200
Bone dust, boneblack, and bone ash ...	876,600	676,400	749,000
Glue, etc ...	419,400	361,800	330,600
Albumin and casein ...	361,800	271,600	657,100
Bedfeathers:			
Crude ...	4,164,000	4,269,700	5,401,600
Prepared, etc ...	668,500	762,800	792,800
Hides and skins:			
Hides of cattle—			
Green and salted ...	13,880,600	17,219,300	17,819,800
Tanned and dried ...	8,011,100	11,241,900	11,875,200
Calfskins—			
Green and salted ...	2,285,000	3,337,900	3,739,000
Tanned and dried ...	7,915,600	6,208,500	6,971,700
Horsehides—			
Green and salted ...	2,288,400	2,682,700	2,460,700
Tanned and dried ...	485,300	675,700	710,400
Sheepskins ...	2,225,800	5,051,100	5,814,800
Goatskins ...	3,024,000	3,511,500	4,380,400
All other hides and skins (not furs) ...	1,340,400	2,785,800	3,287,900
Hide cuttings ...	755,400	556,400	508,800
Leather:			
Sole leather ...	722,300	790,200	748,000
Sheep and goat, half dressed ...	4,722,400	5,606,100	4,899,700
Patent and colored, and glove leather ...	2,348,100	2,589,900	2,675,800
All other ...	1,933,000	1,772,100	2,044,700
Meat and meat products:			
Beef, fresh (and veal) ...	2,798,200	2,377,100	3,238,200
Pork, fresh ...	4,914,700	2,108,400	1,018,200
Mutton, fresh ...	43,300	38,300	47,100
Other fresh meats ...	700,000	1,000	200

Value of animals and animal products imported into Germany during the calendar years 1902, 1903, and 1904—Continued.

Article imported.	1902.	1903.	1904.
Meat and meat products—Continued.			
Beef (and veal), salted, etc	$733,800	$923,700	$873,500
Pork, salted, etc	1,535,800	852,500	447,400
Hams	822,500	492,400	315,800
Bacon	2,156,800	1,207,100	514,300
Horses	38,300	42,100	35,200
Other prepared meats	17,800	13,300	11,700
Canned meats	10,200	10,300	11,200
Meat extracts	2,494,500	1,761,200	1,888,500
Poultry, dead	2,045,400	2,016,300	1,992,100
Oleomargarine	4,388,200	6,398,400	4,869,200
Lard	16,643,800	20,537,700	19,292,800
Stearin, palmitin, etc	874,400	1,130,300	1,472,900
Tallow	3,722,300	3,937,700	3,381,000
Other animal fats	570,000	510,700	630,900
Sausage casings, etc	10,898,700	11,421,400	7,096,900
Dairy products:			
Butter, fresh or salted	6,076,100	9,462,600	14,221,200
"Melted butter"	317,000	344,900	376,300
"Margarin"	77,800	45,000	37,600
Cheese	5,035,100	5,380,900	5,793,200
Fresh milk and cream	433,200	559,500	660,900
Buttermilk, whey, and skim milk	1,200	1,200	1,000
Condensed milk	1,900	4,800	6,900
Eggs and egg yolks	27,420,000	26,667,900	26,761,000
Animals, live:			
Horses—			
Working—			
Light	5,427,400	6,855,100	3,732,300
Heavy	13,553,900	14,582,300	15,843,900
Stallions for breeding	335,300	301,100	228,500
For pleasure	1,886,400	1,771,400	1,769,800
Ponies, etc	75,000	71,200	64,700
Foals (with mare)	10,500	16,400	4,300
Mules and asses	29,700	16,900	15,700
Cows	8,553,500	9,652,800	8,849,600
Steers	808,700	814,700	853,200
Oxen	7,289,000	10,041,800	11,330,700
"Young cattle" (under 2½ years)	4,753,300	5,665,400	5,542,500
Calves (under 6 weeks)	343,900	296,100	220,600
Hogs	1,696,900	2,244,100	1,717,600
Sucking pigs	8,800	5,500	5,500
Sheep	35,500	38,800	29,500
Lambs	200	500	500
Goats	15,000	19,000	9,000
Geese	5,024,200	6,007,600	5,453,800
Chickens	2,773,700	2,752,500	2,830,300
Other live poultry	895,800	965,100	941,100
Hair and wool:			
Bristles	4,982,300	5,043,900	5,537,100
Horsehair	1,258,500	1,259,300	1,370,200
Prepared	130,200	133,300	148,500
Hair of alpaca, camel, etc	344,900	470,800	374,600
Hair of rabbit, etc	781,400	767,300	822,500

Value of animals and animal products imported into Germany during the calender years 1902, 1903, 1904—Continued.

Article imported.	1902.	1903.	1904.
Hair and wool—Continued.			
Wool—			
Raw	$46,559,700	$59,010,900	$55,036,100
Scoured	15,203,200	11,923,100	10,710,500
Combed	16,973,900	13,486,300	14,423,500
Miscellaneous	1,290,000	1,238,600	1,040,500
Waste and shoddy	1,059,800	1,819,700	3,415,100
Wool yarns	13,383,500	14,711,000	12,965,100
Mohair and alpaca yarns	7,675,700	7,084,800	6,349,600
Yarn from cattle hair	85,900	110,400	137,600
Total	318,138,700	349,413,700	344,265,400

EXPORTS OF ANIMAL PRODUCTS TO FRANCE.

Below are presented similar tables regarding the foreign trade of France in animals and animal products as have been given for the United Kingdom and Germany. Contrary to the last-named countries, France is, like our own country, largely able to depend upon her own resources for such quantities of these products as are used for home consumption. It will be seen, however, from the second table that the French purchase considerable quantities of live animals, meat products, dairy products, hides and skins, leather, and wool. Our present trade in these articles with the French Republic is very small. There is, therefore, much room for improvement.

The first table below shows that our shipments to France, inconsiderable at best, declined about 25 per cent last year as compared with 1903. There was a decrease in all the items but two, of which hides and skins alone showed a healthy advance.

Quantity and value of animals and animal products purchased by France from the United States during the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Horses ......number			2	$1,000
Hides and skins (other than furs) ......pounds	977,578	$94,573	2,386,779	218,524
Leather (upper) ......do		605,688		448,976
Beef:				
Canned ......do	380,530	36,958	364,113	35,998
Salted, etc ......do	234,000	14,204	172,970	8,812
Tallow ......do	12,729,106	694,746	6,760,360	320,385
Bacon ......do	930,215	96,027	331,779	31,264
Hams ......do	96,365	10,418	26,500	2,990
Pork ......do	133,437	12,815	45,700	3,515
Lard ......do	7,349,167	667,087	6,002,589	448,451
Total		2,232,516		1,519,915

The imports of animal products into France from all sources for the past three years (excluding the transit trade) were as follows:

Value of animals and animal products imported into France during the calendar years 1902, 1903, and 1904.

[Compiled from "Documents statistiques réunis par l'administration des douanes sur le commerce de la France," published by the French Government.]

Article.	1902.	1903.	1904.
Live animals:			
Horses	$2,351,500	$2,545,900	$2,167,400
Mules	166,000	162,100	177,900
Asses	47,100	58,700	64,800
Cattle	2,037,300	1,946,000	1,319,000
Sheep	7,425,700	8,022,000	6,120,600
Goats	8,300	11,600	9,300
Hogs	84,500	175,100	65,200
Poultry	333,700	293,600	283,100
Meats and meat products:			
Beef, fresh	345,500	316,500	292,800
Mutton, fresh	37,200	40,100	31,100
Pork, fresh	166,900	168,100	30,700
Beef, salt	33,000	37,200	41,500
Hams and bacon	1,341,500	1,313,000	1,203,400
Poultry, dead	373,300	371,900	388,100
Sausage	727,000	705,600	542,700
Sausage casings	234,900	265,800	285,800
Canned meats	79,300	71,400	71,200
Meat extracts	408,200	419,200	444,300
Pâtés de foie gras	41,300	51,100	54,600
Tallow	1,450,000	2,708,600	1,359,300
Lard	499,100	846,300	749,000
Margarine, etc	23,700	14,900	6,600
Other animal fats	573,400	531,300	589,200
Eggs	4,258,200	4,073,800	4,566,200
Egg yolks (not for food)	248,200	387,700	277,900
Hides and skins (not furs)	29,203,600	30,811,100	29,253,800
Hide cuttings	179,100	176,000	153,000
Leather	7,076,700	7,906,400	7,057,000
Wool:			
Raw	65,245,400	63,699,100	64,888,900
Combed, colored, etc	130,300	159,600	134,900
Wool waste	4,258,200	5,704,900	5,147,500
Wool yarns	1,711,900	1,808,200	1,434,400
Bristles	1,025,600	1,042,400	1,020,800
Horsehair	637,700	682,300	807,900
Hair of goat, etc	411,900	390,400	387,700
Mohair:			
Combed or carded	115,200	106,300	64,800
Yarns	1,097,200	1,237,900	1,120,600
Hair, other	169,300	241,200	380,400
Bed feathers	136,600	124,300	110,200
Feathers for quills	17,600	17,200	15,600
Dairy products:			
Butter	3,155,000	2,688,500	2,443,200
Cheese	7,051,100	6,982,500	6,277,900
Milk	12,900	10,800	10,800
Condensed	99,200	108,900	104,000

Value of animals and animal products imported into France during the calendar years 1902, 1903, and 1904—Continued.

Article.	1902.	1903.	1904.
Animal fertilizer	$835,700	$792,800	$912,900
Bones, horns, etc	2,510,400	2,963,100	2,723,000
Bone, ground	61,400	135,700	101,300
Boneblack	54,400	59,100	27,[illegible]00
Animal products not mentioned	1,089,700	1,199,100	931,400
Total	149,580,900	154,585,300	146,650,900

EXPORTS OF MEAT AND DAIRY PRODUCTS.

The great bulk of our export trade in animal products comes under this head; it will therefore be of interest to present some statements giving details of this important branch of our foreign commerce. These will consist of (1) the average annual unit prices obtained for the various products since 1896, (2) the annual totals (quantity and value) of each product sent abroad since 1896, and (3) the distribution, by countries, of each item in 1904.

Average annual prices per pound of exports of principal meat and dairy products, 1896–1904.

Year.	Beef.			Bacon.	Hams.	Salt pork.	Lard.	Oleo oil, etc.	Tallow.	Butter.	Cheese.
	Canned.	Fresh.	Salt.								
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1896	8.72	7.95	5.48	7.11	9.70	5.04	5.67	6.84	3.90	14.36	8.64
1897	8.71	7.97	5.12	6.89	9.64	5.18	5.18	6.05	3.65	14.55	9.03
1898	9.11	8.47	5.62	7.39	9.26	5.82	5.90	6.08	3.94	16.15	8.33
1899	9.17	8.74	5.68	7.35	9.70	5.81	6.02	7.10	4.41	16.49	9.73
1900	9.92	8.98	5.82	7.89	10.61	6.65	6.90	7.29	5.05	18.04	10.26
1901	9.83	9.11	5.90	8.80	10.73	8.02	8.50	7.91	5.21	17.26	9.57
1902	10.31	10.34	7.15	10.03	11.62	9.57	10.09	9.66	6.23	18.77	11.05
1903	10.26	9.10	6.37	10.21	11.87	9.68	9.38	8.64	5.23	17.12	11.73
1904	9.93	9.20	5.42	9.85	10.93	8.02	7.86	7.85	4.80	15.74	10.08

The annual quantity and value of each of the meat and dairy products exported since 1896 are as below:

Exports of meats and meat products and dairy products for the years 1896–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article.	Quantity.	Value.	Article.	Quantity.	Value.
Beaf, canned:	*Pounds.*		Hams:	*Pounds.*	
1896	61,168,927	$5,335,283	1896	156,912,852	$15,224,842
1897	42,804,831	3,728,607	1897	171,956,663	16,581,659
1898	37,866,632	3,448,240	1898	220,011,750	20,384,650
1899	49,393,218	4,529,550	1899	216,646,559	21,015,536
1900	51,915,745	5,150,013	1900	198,328,048	21,043,597
1901	53,239,582	5,233,782	1901	230,456,004	24,739,003
1902	81,362,981	8,384,454	1902	224,982,389	26,151,091
1903	66,738,931	6,850,079	1903	205,494,949	24,383,626
1904	52,158,326	5,177,926	1904	188,284,123	20,576,889
Beef, fresh:			Pork, salted or pickled:		
1896	282,925,463	22,498,251	1896	63,544,168	3,204,986
1897	279,882,590	22,298,328	1897	68,764,530	3,563,945
1898	267,458,906	22,644,040	1898	116,865,578	6,804,048
1899	322,635,630	28,194,697	1899	137,573,905	7,996,794
1900	326,356,576	29,307,778	1900	140,915,057	9,380,615
1901	354,421,731	32,294,877	1901	127,863,335	10,254,695
1902	242,015,093	25,028,304	1902	98,262,179	9,404,635
1903	293,401,843	26,692,858	1903	107,082,084	10,367,223
1904	262,328,700	24,142,308	1904	106,473,494	8,542,188
Beef, salted, etc.:			Pork, fresh:		
1896	85,893,296	4,707,094	1896	315,345	18,161
1897	43,854,117	2,244,568	1897	4,185,059	289,237
1898	48,724,793	2,737,304	1898	30,464,516	2,027,565
1899	46,065,647	2,617,828	1899	34,041,243	2,334,826
1900	56,351,147	3,277,680	1900	25,576,765	1,987,566
1901	52,528,512	3,099,492	1901	40,348,780	3,224,726
1902	47,198,997	3,375,401	1902	31,171,784	2,764,950
1903	58,154,546	3,703,177	1903	20,900,694	1,962,557
1904	54,611,813	2,959,886	1904	14,896,636	1,292,854
Tallow:			Pork, canned:		
1896	85,449,086	3,336,111	1899 *a*	3,570,524	270,577
1897	55,609,096	2,029,735	1900	9,368,005	744,197
1898	106,819,190	4,209,395	1901	9,341,262	744,455
1899	97,213,186	4,283,751	1902	13,044,954	1,240,331
1900	92,555,436	4,674,801	1903	10,817,461	1,127,495
1901	51,846,765	2,698,692	1904	10,516,238	1,037,537
1902	21,365,465	1,330,604	Lard:		
1903	63,537,840	3,320,080	1896	526,320,203	29,821,308
1904	62,708,783	3,012,897	1897	630,060,611	32,622,409
Bacon:			1898	736,636,222	43,440,170
1896	436,859,660	31,057,506	1899	690,068,669	41,531,142
1897	578,082,822	39,820,382	1900	609,473,372	42,033,597
1898	619,683,235	45,786,045	1901	607,266,176	51,626,346
1899	558,005,388	41,008,919	1902	504,153,355	50,869,599
1900	469,924,828	37,099,980	1903	535,375,757	50,224,669
1901	447,620,337	39,402,500	1904	563,520,159	44,304,628
1902	270,141,141	27,101,431	Mutton:		
1903	213,519,817	21,800,532	1896	342,431	27,173
1904	252,515,667	24,865,126	1897	519,986	41,456

Exports of meats and meat products and dairy products for the years 1896–1904—Cont'd.

Article.	Quantity.	Value.
Mutton—Continued.	*Pounds.*	
1898	285,527	$22,147
1899	719,399	57,290
1900	735,675	53,215
1901	298,700	22,815
1902	3,790,019	319,327
1903	2,780,265	253,384
1904	599,902	47,091
Oleo oil and oleomargarine:		
1896	120,686,267	8,255,849
1897	122,055,911	7,391,091
1898	142,272,339	8,654,721
1899	144,438,709	10,241,347
1900	164,321,706	11,985,976
1901	168,923,216	13,451,234
1902	114,482,615	11,124,850
1903	159,492,029	13,780,049
1904	160,549,112	12,609,895
Sausage and sausage meats:		
1900[a]	5,867,982	543,804
1901	7,140,383	699,841
1902	6,328,527	672,770
1903	5,262,081	586,384
1904	5,874,715	640,168
Sausage casings:		
1896		1,686,930
1897		1,677,033
1898		1,762,431
1899		1,899,164
1900		2,931,603
1901		2,022,496
1902		1,755,293
1903		2,220,126
1904		2,606,879
Meat products not specified:		
1896		2,413,281
1897		3,243,188
1898		5,190,547
1899		5,810,955
1900		5,015,000
1901		5,672,446
Meat products not specified—Cont'd.	*Pounds.*	
1902		$4,487,623
1903		4,215,131
1904		3,934,934
Poultry and game:		
1896		51,981
1897		66,316
1898		91,819
1899		236,322
1900		679,440
1901		866,322
1902		847,430
1903		1,138,816
1904		1,075,946
Butter:		
1896	27,220,213	3,909,900
1897	30,914,783	4,497,878
1898	15,034,189	2,428,143
1899	27,309,869	4,502,744
1900	13,283,557	2,396,062
1901	24,249,565	4,184,966
1902	8,959,316	1,681,723
1903	9,345,516	1,600,323
1904	13,880,287	2,184,082
Cheese:		
1896	44,530,234	3,846,703
1897	60,180,651	5,432,371
1898	40,523,994	3,376,818
1899	34,686,833	3,376,108
1900	54,059,049	5,549,254
1901	31,396,115	3,006,344
1902	19,095,438	2,109,347
1903	19,634,239	2,302,118
1904	19,128,902	1,928,639
Milk:		
1896		397,181
1897		635,370
1898		692,925
1899		1,188,057
1900		1,288,127
1901		1,646,579
1902		1,090,051
1903		1,018,063
1904		1,849,513

[a] Included in "All other meat products" previous to 1899.

The following table shows the geographical distribution (by quantities and values) of each of the above products for the calendar year 1904.

Quantity and value of exports of meat and meat products and dairy products for the calendar year 1904, by countries.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Article, and country to which exported.	Quantity.	Value.
Beef, canned:	*Pounds.*	
United Kingdom	36,398,244	$3,666,810
Belgium	515,655	51,553
France	364,113	35,998
Germany	1,221,900	119,850
Italy	119,120	12,055
Netherlands	432,505	42,512
Other Europe	1,274,618	124,058
British North America	649,764	64,718
Central American States and British Honduras	207,283	19,630
Mexico	258,610	26,931
Cuba	91,699	8,111
Other West Indies and Bermuda	534,969	52,308
Argentina	6,837	712
Brazil	67,369	7,063
Colombia	39,049	3,906
Other South America	258,225	25,591
Chinese Empire	597,090	72,468
British East Indies	151,170	14,522
Hongkong	178,419	17,527
Japan	3,649,419	242,329
British Australasia	161,689	14,247
Philippine Islands	160,789	15,158
Other Asia and Oceania	66,675	6,822
British Africa	3,838,756	443,431
All other Africa	914,359	89,716
Total	52,158,326	5,177,926
Beef, fresh:		
United Kingdom	260,875,769	24,017,354
British North America	252,565	25,913
West Indies and Bermuda	1,044,315	85,440
Other countries	156,051	13,601
Total	262,328,700	24,142,308
Beef, salted, etc.:		
United Kingdom	16,295,123	904,370
Belgium	2,555,351	133,874
France	172,970	8,812
Germany	6,976,156	406,950
Netherlands	1,085,500	57,594
Other Europe	3,744,115	202,463
British North America	6,654,024	325,038
Central American States and British Honduras	1,018,496	58,659
Mexico	21,171	1,385
Cuba	43,345	2,521
Other West Indies and Bermuda	6,300,768	343,935

Quantity and value of exports of meat and meat products and dairy products for the calendar year 1904, by countries—Continued.

Article, and country to which exported.	Quantity.	Value.
Beef, salted, etc.—Continued.	*Pounds.*	
Brazil	25,250	$1,455
Chile	126,930	600,432
Colombia	222,677	11,965
Other South America	2,891,490	158,505
Asia and Oceania	5,250,405	269,376
British Africa	1,019,425	55,024
All other Africa	178,717	10,068
Other countries	29,900	1,410
Total	54,611,813	2,959,886
Tallow:		
United Kingdom	33,840,483	1,589,933
Belgium	2,219,783	109,851
France	6,760,360	320,385
Germany	7,187,736	355,594
Italy	2,131,519	103,302
Netherlands	1,612,060	81,080
Other Europe	3,403,351	158,262
British North America	100,372	400,131
Central American States and British Honduras	2,057,664	112,424
Mexico	485,714	21,887
Cuba	513,538	25,125
Other West Indies and Bermuda	1,093,047	56,486
Brazil	71,194	4,397
Chile	250,971	12,089
Colombia	176,620	10,154
Other South America	722,362	41,510
Asia and Oceania	37,082	2,190
Other countries	44,927	4,097
Total	62,708,783	3,012,897
Bacon:		
United Kingdom	208,901,184	20,964,520
Belgium	10,698,764	882,119
France	331,779	31,264
Germany	6,423,847	561,343
Netherlands	2,763,205	264,542
Other Europe	13,249,795	1,172,470
British North America	3,142,153	320,623
Central American States and British Honduras	244,080	25,582
Mexico	311,827	43,920
Cuba	4,554,419	395,829
Other West Indies and Bermuda	172,634	20,292
Brazil	856,116	81,139
Colombia	17,693	1,932
Other South America	169,884	17,282
Chinese Empire	145,250	21,778
Philippine Islands	85,614	12,513
Other Asia and Oceania	413,699	44,847
British Africa	840	82
All other Africa	32,884	3,049
Total	252,515,667	24,865,126

Quantity and value of exports of meat and meat products and dairy products for the calendar year 1904, by countries—Continued.

Article, and country to which exported.	Quantity.	Value.
Hams:	*Pounds.*	
United Kingdom	168,061,786	$18,354,844
Belgium	6,311,775	662,370
France	26,500	2,990
Germany	208,867	22,059
Netherlands	602,099	65,398
Other Europe	1,466,518	156,262
British North America	2,461,758	299,766
Central American States and British Honduras	422,014	48,496
Mexico	767,897	100,418
Cuba	4,585,833	466,701
Other West Indies and Bermuda	1,829,225	201,497
Brazil	18,118	2,029
Colombia	73,718	8,607
Venezuela	343,112	40,591
Other South America	270,163	32,650
Chinese Empire	234,714	34,027
British Australasia	1,245	168
Philippine Islands	111,292	16,203
Other Asia and Oceania	145,347	21,446
British Africa	331,696	39,021
All other Africa	2,811	333
Other countries	7,635	1,015
Total	188,284,123	20,576,889
Pork, canned	10,516,238	1,037,537
Pork, fresh and salted:		
United Kingdom	74,639,498	6,324,665
Belgium	3,726,009	265,121
France	45,700	3,515
Germany	2,275,558	189,428
Netherlands	1,526,284	117,994
Other Europe	8,600,815	622,314
British North America	9,747,044	705,504
Central American States and British Honduras	1,754,927	142,045
Cuba	3,722,926	269,303
Other West Indies and Bermuda	9,402,654	697,935
Brazil	533,301	41,280
Colombia	82,900	6,719
Other South America	2,828,925	216,862
Philippine Islands	1,700	143
Other Asia and Oceania	148,527	12,441
British Africa	2,282,130	215,643
All other Africa	18,990	1,470
Other countries	32,242	2,660
Total	121,370,130	9,835,042
Lard:		
United Kingdom	214,119,382	16,591,818
Belgium	24,739,345	1,976,700
France	6,002,589	448,451
Germany	172,337,675	13,704,402
Italy	3,858,519	301,447

Quantity and value of exports of meat and meat products and dairy products for the calendar year 1904, by countries—Continued.

Article, and country to which exported.	Quantity.	Value.
Lard—Continued.	*Pounds.*	
Netherlands	62,053,173	$5,084,306
Other Europe	25,359,631	1,955,715
British North America	2,030,660	165,719
Central American States and British Honduras	2,246,493	167,463
Mexico	2,957,358	240,532
Cuba	21,758,542	1,593,086
Other West Indies and Bermuda	7,479,497	549,364
Argentina	35,655	3,040
Brazil	3,067,395	262,468
Chile	683,379	50,157
Colombia	2,240,068	165,343
Venezuela	3,518,196	264,121
Other South America	4,412,480	379,958
Philippine Islands	233,353	22,174
Other Asia and Oceania	1,374,194	102,246
British Africa	2,648,215	239,596
All other Africa	463,820	36,480
Other countries	540	42
Total	563,520,159	44,304,628
Lard compounds, etc	53,147,716	3,375,018
Mutton	599,902	47,091
Oleo and oleomargarine:		
United Kingdom	9,849,180	763,474
Germany	28,015,125	2,230,745
Netherlands	90,635,054	7,114,158
Other Europe	28,177,410	2,148,056
British North America	1,212,175	97,276
Central American States and British Honduras	191,816	17,096
Mexico	107,275	13,586
West Indies and Bermuda	2,153,466	205,948
Colombia	12,507	1,207
Other South America	82,117	7,720
Asia and Oceania	75,124	6,110
Other countries	37,863	4,509
Total	160,549,112	12,609,895
Poultry and game	....	1,075,946
Sausage and sausage meats	5,874,715	640,168
Sausage casings	....	2,606,879
All other meat products	....	3,934,934
Butter:		
United Kingdom	8,018,071	1,211,119
Germany	778,374	116,533
Other Europe	428,851	65,834
British North America	763,963	141,673
Central American States and British Honduras	312,957	69,981
Mexico	506,897	109,886
Cuba	115,254	24,022
Other West Indies and Bermuda	1,122,386	182,809
Brazil	914,333	120,082
Colombia	91,903	15,438

Quantity and value of exports of meat and meat products and dairy products for the calendar year 1904, by countries—Continued.

Article, and country to which exported.	Quantity.	Value.
Butter—Continued.	*Pounds.*	
Venezuela	611,215	$83,777
Other South America	89,483	14,767
Chinese Empire	19,563	4,458
Japan	66,806	14,726
Philippine Islands	5,384	944
Other Asia and Oceania	30,424	7,296
British Africa	875	175
All other Africa	295	72
Other countries	3,253	490
Total	13,880,287	2,184,082
Cheese:		
United Kingdom	17,159,811	1,675,482
Germany	28,198	2,917
British North America	82,725	10,958
Central American States and British Honduras	278,031	35,988
Mexico	362,126	46,941
Cuba	79,941	13,465
Other West Indies and Bermuda	679,308	84,374
Brazil	465	21
Colombia	27,621	3,314
Other South America	5,562	735
Chinese Empire	170,908	21,709
Japan	24,935	3,229
Philippine Islands	2,153	318
Other Asia and Oceania	211,553	27,377
Other countries	15,565	1,811
Total	19,128,902	1,928,639
Milk	....	1,849,513

HIDES AND SKINS.

The various classes of hides and skins (other than furs) form by far the largest item of our imports of animal products; their annual value exceeds, in fact, that of all the other imports combined. In point of value the most important of the classes is goatskins (not Angora), nearly one-half the total of 1904 going for them. They are admitted free of duty. The next largest class is cattle hides, paying a duty of 15 per cent; after which come sheepskins (free) and calfskins (free). The most recent unit figures of the above are: 28 cents per pound for the goatskins; 16 cents per pound for sheepskins; 13 cents for the cattle hides, and 17 cents for the calfskins.

The annual imports and exports (quantity and value) of hides and skins since 1896 were as follows:

Imports and exports of hides and skins for the years 1896-1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Calendar year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
1896	146,159,006	$20,713,528	42,009,166	$3,481,364
1897	236,372,088	33,230,749	18,778,031	1,553,622
1898	256,188,970	39,906,373	11,397,129	1,018,433
1899	318,261,631	51,127,659	7,514,483	769,927
1900	307,315,840	51,587,993	10,635,394	1,051,435
1901	310,539,594	55,565,388	8,736,495	860,961
1902	325,106,531	57,732,397	10,991,603	1,025,157
1903	289,001,032	53,280,944	21,251,307	2,078,414
1904	300,860,592	57,618,149	24,514,226	2,430,894

The geographical distribution of the imports and exports for the year 1904 are shown next.

Quantity and value of imports and exports of hides and skins (other than furs) for the calendar year 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Country from which imported or to which exported.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*	
United Kingdom	31,516,319	$5,545,062	2,803,081	$287,851
Belgium	....	....	553,436	52,323
France	20,291,382	4,076,826	2,386,779	218,524
Germany	19,454,591	4,155,937	5,293,092	482,032
Netherlands	....	....	4,357,152	446,607
Other Europe	49,812,593	9,551,355	2,106,755	208,078
British North America	25,049,384	2,384,523	6,818,002	717,808
Mexico	15,342,728	3,279,561	156,586	12,990
Central America	4,032,297	654,456	....	....
West Indies and Bermuda	1,991,939	412,236	3,827	836
South America	59,742,723	11,808,606	....	....
East Indies	43,583,637	8,717,310	....	....
Japan	....	....	17,766	2,067
Other Asia and Oceania	26,437,393	6,243,168	7,690	773
Africa	3,605,606	789,109	....	....
Other countries	....	....	10,060	1,005
Total	300,860,592	57,618,149	24,514,226	2,430,894

It may be interesting to show in a general way, by means of the table below, the total value of the skins (raw and manufactured) of the common goat which enter our country annually. It is proper to state, however, that about half of the gloves are of sheep origin.

Statement of annual imports of goatskins, morocco leather, and gloves for the years 1896–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Calendar year.	Goatskins.		Morocco leather.	Gloves.
	Quantity.	Value.	Value.	Value.
	Pounds.			
1896	38,882,234	$8,803,609	$2,808,322	$5,618,311
1897	59,177,556	13,802,504	3,748,341	6,337,410
1898	65,546,570	16,854,430	2,452,655	5,686,464
1899	80,064,583	20,992,949	2,831,035	5,544,871
1900	69,104,372	19,008,097	2,940,949	6,433,941
1901	88,043,928	25,265,670	2,399,603	5,060,224
1902	83,115,160	24,171,569	2,037,556	5,135,590
1903	82,052,437	23,441,687	2,030,389	5,447,379
1904	95,447,448	25,962,620	2,136,824	4,636,213

LEATHER AND LEATHER MANUFACTURES.

The product of our tanneries and leather factories forms a large and increasing portion of our foreign trade. The imports of leather consist almost wholly of morocco skins and dressed upper leather, in about equal parts. Of the total amount which we received for our exports, about two-thirds is for upper leather and one-third for sole leather.

It will be seen from the detailed statement below that about four-fifths of the imports of leather manufactures are gloves, the remainder being too unimportant to mention separately. Boots and shoes are the large item in the exports; 4,806,279 pairs were sent out of the country last year, the total value of which was $7,319,775.

The annual totals of the imports and exports since 1896 are as below:

Value of imports and exports of leather and leather manufactures for the years 1896–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Calendar year.	Leather.		Leather manufactures.	
	Imports.	Exports.	Imports.	Exports.
1896	$5,104,571	$16,279,947	$6,103,713	$2,597,510
1897	6,373,726	16,321,849	6,789,576	2,904,819
1898	5,236,171	18,682,843	6,113,256	3,233,979
1899	5,750,937	22,104,451	6,143,380	4,705,382
1900	6,196,687	21,297,539	7,101,109	5,871,475
1901	5,507,377	21,776,362	5,868,628	7,173,087
1902	5,051,361	22,820,396	6,160,409	7,730,676
1903	5,136,405	23,697,409	6,571,344	9,036,196
1904	5,061,965	26,710,394	5,808,249	9,114,098

The details of our foreign trade in leather and leather manufactures for 1904 are shown in the accompanying table.

Quantity and value of imports and exports of leather and leather manufactures for the calendar year 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

IMPORTS.

Article and country of import or export.	Quantity.	Value.
Leather:	*Pounds.*	
Band or belting and sole leather		$55,356
Calfskins, tanned, etc		672,918
Skins for morocco		2,136,824
Upper leather and skins, dressed, etc		2,196,867
Total leather		5,061,965
Leather manufactures:		
Gloves—		
Belgium		66,133
France		1,721,942
Germany		1,790,736
Other Europe		1,056,564
Other countries		838
Total		4,636,213
All other manufactures		1,172,036
Total manufactures		5,808,249

EXPORTS.

Article and country of import or export.	Quantity.	Value.
Sole leather:	*Pounds.*	
United Kingdom	30,597,069	$5,622,475
Belgium	795,269	166,601
Germany	18,112	3,684
Italy	68,581	13,287
Netherlands	158,829	29,976
Other Europe	1,717,158	344,736
British North America	505,445	95,144
West Indies and Bermuda	33,689	7,100
South America	5,064	1,156
Japan	9,337,493	2,227,577
British Australasia	104,901	32,241
Philippine Islands	14,236	3,906
Other Asia and Oceania	197,175	61,829
British Africa	225,713	50,154
Other Africa	2,363	443
Other countries	89,141	24,881
Total	43,870,238	8,685,190
Upper and other leather:		
United Kingdom		11,097,975
Belgium		742,131
France		448,976
Germany		991,137
Italy		65,392
Netherlands		1,179,820
Other Europe		682,545
British North America		539,038

Quantity and value of imports and exports of leather and leather manufactures for the calendar year 1904—Continued.

EXPORTS—Continued.

Article and country of import or export.	Quantity.	Value.
Upper and other leather—Continued.	*Pounds.*	
Central American States and British Honduras		$129,088
Mexico		65,620
Cuba		200,254
Other West Indies and Bermuda		252,930
Argentina		98,957
Brazil		39,705
Chile		35,863
Colombia		66,938
Venezuela		49,171
Other South America		
British Australasia		807,686
Philippine Islands		18,608
Other Asia and Oceania		450,355
British Africa		37,812
Other Africa		25,006
Other countries		197
Total		18,025,204
Total leather		26,710,394
Boots and shoes:	*Pairs.*	
United Kingdom	809,556	1,757,724
Belgium	24,963	53,910
France	21,464	67,578
Germany	124,591	291,177
Netherlands	7,837	11,978
Other Europe	45,258	91,905
British North America	559,691	944,247
Central American States and British Honduras	211,235	267,586
Mexico	550,390	878,535
West Indies and Bermuda	1,680,629	1,585,909
Colombia	103,718	140,733
Other South America	106,220	164,328
British Australasia	338,032	644,270
Philippine Islands	64,745	106,581
Other Asia and Oceania	36,837	65,841
British Africa	113,596	229,841
Other Africa	7,085	16,253
Other countries	432	1,379
Total	4,806,279	7,319,775
Harness and saddlery		478,970
All other manufactures		1,315,353
Total manufactures		9,114,098

WOOL AND WOOL MANUFACTURES.

Raw wool is one of the most important of our imports of animal products. We therefore show our foreign trade in this product in as much detail as the official returns will permit. The figures relating to the manufactures of wool are also given for purposes of comparison.

IMPORTS.

The two tabular statements of the imports given below show (1) the total annual purchases of each class since 1892 and (2) the different countries from which the supply of 1904 originated, giving the quantity and value credited to each. It will be noticed that last year's figures are remarkable for the increased receipts of the better classes of wool—the merino wools and the combing wools. The advance in the total value of the former amounted to upward of 50 per cent, and the total of the combined wools increased 100 per cent. It should be noted that the heavy totals of the years 1895 to 1897 in the first table were caused by changes in the tariff; the years named were the "free-wool" years.

The total annual receipts since 1892 of the several classes of wool, together with the manufactures, were as follows:

Value of imports of wool and wool manufactures for the years 1892–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Calendar year.	Class 1 (clothing wool).	Class 2 [a] (combing wool).	Class 3 (carpet wool).	Manufactures.	Total.
1892	$9,309,640	$1,375,651	$10,505,348	$37,515,445	$58,703,084
1893	5,373,238	895,266	7,485,045	30,238,506	44,182,055
1894	5,315,919	1,166,150	6,780,443	17,342,682	30,605,194
1895	19,657,912	4,092,656	10,019,591	60,319,331	94,089,490
1896	13,077,712	2,032,169	7,311,533	37,109,363	59,530,777
1897	33,953,828	6,946,102	12,532,300	29,330,284	82,762,214
1898	4,639,220	301,337	6,646,019	13,834,296	25,420,872
1899	2,803,680	1,499,276	7,356,688	14,596,847	26,256,491
1900	8,498,228	2,235,096	8,476,738	15,806,112	35,016,174
1901	5,726,006	981,294	7,310,132	15,604,532	29,621,964
1902	7,333,855	2,003,527	10,252,845	18,771,774	38,362,001
1903	6,942,447	2,635,035	13,234,252	19,321,504	42,133,238
1904	10,980,093	5,255,792	13,119,459	16,131,785	45,487,129

[a] Includes mohair, camels' hair, etc.

The detailed imports of 1904 were as below:

Quantity and value of imports of wool and wool manufactures (including hair of goat, camel, etc.) for the calendar year 1904, by countries.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Country from which imported.	Quantity.	Value.
CLASS 1.—*Clothing wool.*	*Pounds.*	
United Kingdom	24,342,655	$4,955,604
France	651,500	142,110
South America	17,766,098	2,795,476
Asia and Oceania	11,169,813	2,513,634
Other countries	2,755,918	573,269
Total	56,685,984	10,980,093

Quantity and value of imports of wool and wool manufactures (including hair of goat, camel, etc.) for the calendar year 1904, by countries—Continued.

Country from which imported.	Quantity.	Value.
CLASS 2.—*Combing wool.*		
United Kingdom	18,732,075	$4,250,532
Other Europe	1,705,563	452,877
British North America	1,758,706	364,947
South America	617,395	182,148
Asia and Oceania	19,964	5,288
Total	22,833,703	5,255,792
CLASS 3.—*Carpet wool.*		
United Kingdom	22,734,193	3,375,001
France	3,369,852	441,709
Germany	647,937	69,831
Other Europe	32,384,559	3,895,840
British North America	11	2
South America	9,621,822	1,025,694
Chinese Empire	24,390,829	2,531,859
Other Asia and Oceania	13,890,879	1,778,727
Other countries	12,914	706
Total	107,052,996	13,119,459
Total unmanufactured	186,572,683	29,355,344
MANUFACTURES.		
Carpets and carpeting:	*Square yards.*	
United Kingdom	157,403	348,867
Other Europe	399,501	1,504,434
Japan	509	1,246
Other Asia and Oceania	103,180	370,397
Other countries	6,550	9,719
Total	667,143	2,234,663
Clothing	....	1,303,965
Cloths:	*Pounds.*	
United Kingdom	1,962,186	2,147,421
Austria-Hungary	153,125	138,722
Belgium	196,538	192,363
France	165,275	208,748
Germany	1,156,436	1,106,235
Other Europe	5,755	6,557
Other countries	5,848	7,037
Total	3,645,163	3,807,083
Dress goods:	*Square yards.*	
United Kingdom	26,581,140	4,373,319
France	9,476,224	2,339,383
Germany	4,815,425	1,067,865
Other Europe	185,527	57,991
Other countries	30,479	7,590
Total	41,088,795	7,846,098
All other manufactures	....	939,976
Total manufactures	....	16,131,758

EXPORTS.

Domestic exports of these products are, of course, very insignificant compared with the imports. The accompanying tables show the total annual value of the shipments since 1892 and such details of the trade of 1904 as are given in the official returns:

Value of exports of wool and wool manufactures for the years 1892–1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Calendar year.	Raw wool.	Manufactures.	Total.
1892	$38,799	$273,835	$312,634
1893	36,139	559,379	595,518
1894	232,162	736,360	968,522
1895	689,874	782,855	1,472,729
1896	968,866	945,103	1,913,969
1897	144,608	1,058,956	1,203,564
1898	14,406	1,020,810	1,035,216
1899	566,295	1,229,539	1,795,834
1900	59,338	1,429,733	1,489,071
1901	15,039	1,531,972	1,547,011
1902	63,814	1,588,058	1,651,872
1903	43,347	2,002,913	2,046,260
1904	20,993	1,971,400	1,992,393

Quantity and value of exports of domestic wool and wool manufactures for the calendar year 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Articles.	Quantity.	Value.
	Pounds.	
Raw wool	183,851	$20,993
Manufactures:	*Yards.*	
Carpets	77,775	61,461
Dress goods	15,847	10,759
Flannels and blankets		77,400
Wearing apparel		1,527,658
All other		294,122
Total		1,971,400

COMMERCE WITH OUR NONCONTIGUOUS TERRITORIES.

The last series of tables will represent our trade in animals and animal products with the principal outlying territories of our country, namely, Alaska, Hawaii, Porto Rico, and the Philippine Islands. These tables are submitted for the information which they convey rather than for the importance of the trade. It will be seen that in only two of the four territories—Alaska and Porto Rico—does the total trade exceed $1,000,000 in value annually. The quantities and

values of the several articles, both to and from each one of the territories, are given in comparative form for the past two years. As is the case throughout this article, the amounts in every instance refer to domestic products only; foreign commerce, which is quite considerable with the Philippine Islands, is excluded.

As none of the territories named is a large producer of animal products, the movement of the commerce, as shown by the tables, is practically all one way. The only item of any size which comes to the United States is hides and skins, most of which come from Hawaii, with Porto Rico not far behind.

The details of the trade with each territory are as follows:

Commerce of the United States in animals and animal products with Alaska for the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

SHIPMENTS FROM UNITED STATES TO ALASKA.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value..
Animals:				
Cattle .... number..	1,268	$58,603	1,192	$69,906
Hogs .... do....	1,142	12,008	733	6,880
Horses .... do....	883	92,699	517	62,025
Mules .... do....	45	3,760	29	3,325
Sheep .... do....	18,855	59,463	2,874	13,006
All other, including fowls .... do....	....	12,411	....	8,934
Bones, hoofs, horns, etc .... do....	....	....	....	1
Eggs .... dozens..	620,316	145,571	784,213	193,676
Feathers	....	659	....	560
Glue .... pounds..	421	60	399	48
Grease, etc	....	1,151	....	861
Hair and manufactures	....	164	....	175
Hides and skins (other than furs) .... pounds..	57	6	....	....
Leather:				
Sole leather .... do....	1,504	532	4,271	1,596
Upper leather	....	147	....	....
All other	....	3,357	....	332
Lard oil	3,814	3,065	3,180	1,896
Other animal oil .... pounds..	165	53	....	....
Meat products:				
Beef—				
Canned .... do....	295,882	32,810	416,605	40,377
Fresh .... do....	1,929,425	165,815	2,549,357	202,215
Salted, etc .... do....	412,084	34,847	402,475	28,870
Bacon .... do....	636,338	97,440	955,081	133,725
Hams .... do....	604,046	87,319	906,530	122,123
Other pork .... do....	266,222	28,922	471,928	44,552
Lard .... do....	399,643	40,966	500,713	45,638
Lard compounds, etc .... do....	20,842	1,860	57,647	4,875
Tallow .... do....	5,942	298	45,043	2,203
Mutton .... do....	225,081	18,824	442,928	34,304
Oleomargarine .... do....	900	135	9,080	1,300
Sausage .... do....	93,287	9,836	184,876	18,168

Commerce of the United States in animals and animal products with Alaska for the calendar years 1903 and 1904—Continued.

SHIPMENTS FROM UNITED STATES TO ALASKA—Continued.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Meat products—Continued.				
Poultry and game	....	$19,031	....	$37,465
All other meat products	....	117,733	....	62,254
Dairy products:				
Butter ....pounds..	890,510	233,492	1,231,419	289,043
Cheese ....do....	166,638	25,173	196,142	25,814
Milk	....	125,891	....	214,077
Wool, raw ....pounds..	....	....	204	40
Total	....	1,434,101	....	1,670,264

SHIPMENTS FROM ALASKA TO UNITED STATES.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Horses ....number..	55	$7,380	63	$7,900
All other	....	715	....	1,546
Bones, horns, etc	....	530	....	4,864
Eggs ....dozens..	1,155	292	300	103
Hides and skins (other than furs) ....pounds..	48,176	5,468	100,029	6,562
Meat products:				
Beef, fresh ....do....	900	90	....	....
Bacon and hams ....do....	70	13	892	103
Pork ....do....	550	40	....	....
Tallow ....do....	3,315	182	5,305	237
All other meat products	....	768	....	677
Dairy products:				
Butter ....pounds..	3,596	941	8,014	1,908
Cheese ....do....	225	35	385	54
Milk	....	121	....	1,180
Total	....	16,575	....	25,134

Commerce of the United States in animals and animal products with Hawaii for the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

SHIPMENTS FROM UNITED STATES TO HAWAII.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle ....number..	81	$2,150	111	$10,286
Hogs ....do....	1,960	15,485	3,834	25,762
Horses ....do....	105	14,100	36	4,575
Mules ....do....	311	38,890	285	35,186
Sheep ....do....	180	645	404	1,809
All other, including fowls	....	3,062	....	4,031
Bones, horns, etc	....	56	....	940
Eggs ....dozens..	96,030	21,085	73,750	17,105
Feathers	....	1,250	....	1,893
Glue ....pounds..	1,693	194	1,623	255

Commerce of the United States in animals and animal products with Hawaii for the calendar years 1903 and 1904—Continued.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

SHIPMENTS FROM UNITED STATES TO HAWAII—Continued.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Grease, etc		$7,028		$5,863
Hair, and manufactures of		371		387
Leather:				
Sole	145,928	40,644	131,894	36,153
Upper		10,167		9,248
Lard oil ... gallons	1,573	1,389	907	723
Meat products:				
Beef—				
Canned ... pounds	688,024	74,433	658,049	69,106
Fresh ... do	59,888	4,715	10,499	1,021
Salt, etc ... do	146,625	8,806	102,639	5,598
Bacon ... do	123,785	20,347	135,558	19,929
Hams ... do	388,631	55,744	344,168	45,603
Pork ... do	197,520	20,671	169,798	16,794
Lard ... do	738,229	67,426	559,063	43,258
Lard compounds, etc ... do	119,553	8,601	232,041	16,061
Tallow ... do	1,250	79	2,065	125
Mutton ... do	157,578	12,510	232,704	16,669
Oleomargarine ... do	700	79	51,800	7,955
Sausage ... do	12,591	2,185	10,214	2,014
Poultry and game		26,506		21,727
All other meat products		38,350		43,009
Dairy products:				
Butter ... pounds	363,674	95,490	423,801	99,901
Cheese ... do	216,661	30,416	212,487	26,079
Milk		96,116		87,531
Total		718,990		676,596

SHIPMENTS FROM HAWAII TO UNITED STATES.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle ... number	1	$250		
Horses ... do	9	2,050	8	$5,200
All other		392		457
Feathers		124		100
Grease, etc		40		
Hides and skins (other than furs) ... pounds	1,013,505	82,509	888,597	72,942
Meat products:				
Beef, canned ... do	320	35	140	16
Tallow ... do	196,741	8,316	164,867	6,084
Hams ... do	1,560	190	204	41
Lard ... do	380	39	250	26
All other meat products		200		364
Dairy products:				
Butter ... pounds			58	10
Cheese ... do	1,025	152	660	126
Milk		137		280
Wool, raw	265,605	33,649	311,952	37,821
Total		128,083		123,467

Commerce of the United States in animals and animal products with Porto Rico for the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

SHIPMENTS FROM UNITED STATES TO PORTO RICO.

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle.....number..	2	$131	3	$300
Hogs.....do....	3	15	1	50
Horses.....do....	6	1,725	26	4,327
Mules.....do....	3	450	27	5,050
All other.....	.....	289	.....	2,264
Bones, horns, etc.....	.....	7,650	.....	11,231
Eggs.....dozen..	9,018	1,794	55	11
Feathers.....	.....	415	.....	1,232
Glue.....pounds..	18,913	2,653	19,287	2,673
Grease, etc.....	.....	3,644	.....	3,454
Hair, and manufactures of.....	.....	323	.....	78
Leather:				
Sole.....pounds..	870	183	5,303	1,114
Upper.....	.....	27,079	.....	32,649
All other.....	.....	2,754	.....	2,075
Lard oil.....gallons..	664	507	.....	.....
Other animal oil.....do....	25	19	146	56
Meat products:				
Beef—				
Canned.....pounds..	53,689	5,292	23,004	2,226
Fresh.....do....	300,572	33,150	50,208	5,452
Salted, etc., and cured.....do....	181,655	12,232	198,344	14,470
Tallow.....do....	4,931	362	2,600	149
Bacon.....do....	109,950	11,631	78,986	7,652
Hams.....do....	1,817,044	181,048	1,556,073	148,592
Pork—				
Canned.....do....	47,806	4,778	20,236	2,057
Fresh.....do....	7,556	999	4,355	457
Salted or pickled.....do....	4,555,297	395,363	3,943,585	302,211
Lard.....do....	2,419,138	198,870	4,079,133	291,936
Lard compounds, etc.....do....	3,845,364	279,569	1,730,597	111,907
Mutton.....do....	23,247	2,762	1,906	164
Sausage, etc.....do....	444,886	49,495	387,021	42,937
Poultry and game.....	.....	4,103	.....	710
All other meat products.....	.....	32,224	.....	8,163
Dairy products:				
Butter.....pounds..	433,881	77,407	395,261	59,453
Cheese.....do....	763,754	98,662	957,494	112,896
Milk.....	.....	15,687	.....	21,736
Total.....	.....	1,453,265	.....	1,199,732

SHIPMENTS FROM PORTO RICO TO UNITED STATES.

Article.	1903. Quantity.	1903. Value.	1904. Quantity.	1904. Value.
Horses.....number..	10	$800	1	$100
Bones, horns, etc.....	.....	1,554	.....	2,331
Hides and skins (other than furs).....pounds..	535,610	66,491	366,494	43,009
Tallow.....do....	32,088	1,441	22,723	1,281
Total.....	.....	70,286	.....	46,721

Commerce of the United States in animals and animal products with the Philippine Islands for the calendar years 1903 and 1904.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

SHIPMENTS FROM UNITED STATES TO PHILIPPINE ISLANDS. [a]

Article.	1903.		1904.	
	Quantity.	Value.	Quantity.	Value.
Animals:				
Cattle ....number..	14	$1,650	1	$125
Hogs ....do....	4	100	.....	.....
All other, including fowls	.....	848	.....	685
Bones, horns, etc	.....	200	.....	620
Feathers	.....	2	.....	232
Glue ....pounds..	4,173	551	1,130	122
Grease, etc	.....	2,179	.....	1,225
Hair, and manufactures of	.....	523	.....	6,064
Leather:				
Sole leather ....pounds..	9,383	2,784	14,236	3,906
Upper leather	.....	13,980	.....	16,471
All other leather	.....	1,730	.....	3,847
Lard oil ....gallons..	6,854	5,451	50	33
Other animal oil ....do....	3,110	1,910	.....	.....
Meat products:				
Beef—				
Canned ....pounds..	347,301	37,074	160,789	15,158
Fresh ....do....	.....	.....	6,820	903
Salted, etc ....do....	1,710	85	3,150	142
Tallow ....do....	.....	.....	250	12
Bacon ....do....	179,105	27,899	85,614	12,513
Hams ....do....	168,468	24,362	111,292	16,203
Pork—				
Canned ....do....	69,854	6,647	40,771	5,220
Fresh ....do....	36,198	3,912	.....	.....
Salted, etc ....do....	44,850	4,526	1,700	143
Lard ....do....	224,829	22,981	233,322	22,173
Lard compounds, etc ....do....	14,400	986	.....	.....
Poultry and game	.....	100	.....	1,266
Sausage and sausage meats ....pounds..	10,852	1,524	10,151	1,323
Sausage casings	.....	325	.....	.....
All other meat products	.....	36,039	.....	22,380
Dairy products:				
Butter ....pounds..	30	10	9,884	1,675
Cheese ....do....	7,287	1,143	2,153	318
Milk	.....	126,961	.....	81,343
Total	.....	326,482	.....	214,102

[a] Shipments from Philippine Islands to United States: None.

FARM ANIMALS IN 1904.

NUMBER AND VALUE OF FARM ANIMALS.

Number, average price, and value of farm animals in the United States in 1904.

[From Bureau of Statistics, Department of Agriculture.]

State or Territory.	Horses.			Mules.			Milch cows.		
	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.
Maine	136,150	$82.08	$11,175,449				189,125	$29.16	$5,514,885
New Hampshire	63,625	79.08	5,031,342				129,900	32.34	4,200,966
Vermont	90,894	79.74	7,248,213				285,315	24.06	6,864,679
Massachusetts	143,139	110.45	15,809,296				190,627	36.34	6,927,385
Rhode Island	15,764	90.76	1,430,699				95,466	41.70	1,061,932
Connecticut	58,002	93.26	5,409,438				130,863	34.94	4,472,353
New York	637,600	94.22	60,077,605	3,787	$102.26	$387,253	1,721,541	31.72	54,607,281
New Jersey	94,278	98.58	9,293,580	4,974	113.45	564,316	184,618	39.33	7,261,026
Pennsylvania	607,506	92.56	56,230,311	38,532	99.87	3,848,129	1,086,723	29.91	32,503,885
Delaware	35,089	80.48	2,823,805	5,387	98.30	529,561	35,127	29.25	1,027,465
Maryland	143,683	79.71	11,452,476	18,080	100.93	1,824,745	147,423	29.54	4,354,875
Virginia	262,506	74.80	19,635,500	42,015	93.46	3,926,864	252,757	24.92	6,297,957
North Carolina	164,030	87.25	14,311,389	142,217	102.92	14,636,500	193,482	20.90	4,043,774
South Carolina	74,731	88.45	6,610,239	106,592	110.20	11,746,672	109,704	24.64	2,703,107
Georgia	123,141	99.42	12,243,293	201,060	117.96	23,716,413	277,295	24.73	6,857,505
Florida	47,413	80.99	3,839,931	16,025	120.87	1,936,948	87,010	23.48	2,042,995
Alabama	147,754	71.33	10,539,723	161,599	97.52	15,758,485	230,120	19.63	4,517,256
Mississippi	252,226	62.98	15,886,143	219,902	95.13	20,919,089	272,004	22.50	6,120,090
Louisiana	183,068	52.93	9,690,587	137,574	104.51	14,377,177	166,320	22.84	3,798,749
Texas	1,277,768	35.46	45,308,760	391,038	60.87	23,803,473	838,431	19.82	16,617,702
Arkansas	253,419	56.52	14,322,391	158,505	78.67	12,469,563	280,863	17.27	4,850,504
Tennessee	273,326	78.61	21,408,453	163,991	93.84	15,389,200	282,529	21.88	6,181,735
West Virginia	169,030	74.64	12,616,713	9,888	82.00	810,490	180,379	28.05	5,059,631
Kentucky	395,352	71.15	28,127,471	177,030	86.20	15,260,524	286,716	24.00	6,881,184
Ohio	785,893	87.28	68,590,061	16,454	86.83	1,428,700	790,695	31.81	25,152,008
Michigan	553,499	87.71	48,545,800	2,632	68.49	180,272	556,149	28.77	16,000,407
Indiana	636,141	87.42	55,608,572	57,435	87.21	5,009,084	547,584	29.63	16,224,914
Illinois	1,232,304	85.04	104,795,162	127,570	87.17	11,120,709	995,429	29.53	29,395,018
Wisconsin	567,554	86.20	48,921,705	4,748	72.33	343,442	1,095,862	27.85	30,519,757
Minnesota	688,706	75.97	52,320,858	8,082	75.59	610,957	836,848	24.65	20,628,303
Iowa	1,144,456	74.49	85,250,746	44,096	80.05	3,529,755	1,335,832	27.90	37,269,713
Missouri	809,887	69.14	55,995,599	243,466	79.92	19,457,407	569,787	24.53	13,976,875
Kansas	880,627	65.92	58,052,253	107,112	75.67	8,105,476	671,276	23.69	15,902,528
Nebraska	795,552	62.26	49,534,566	52,844	75.11	3,969,198	669,334	25.83	17,288,897
South Dakota	467,258	58.59	27,375,247	6,962	68.00	473,440	401,703	24.65	9,901,979
North Dakota	391,705	70.06	27,443,401	7,457	83.77	624,707	194,332	26.18	5,087,612
Montana	236,781	38.37	9,084,698	3,424	57.17	195,754	55,030	32.88	1,809,386
Wyoming	101,237	29.92	3,029,508	1,481	51.05	75,608	20,167	34.58	697,375

Number, average price, and value of farm animals in the United States in 1904—Continued.

State or Territory.	Horses.			Mules.			Milch cows.		
	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.
Colorado	219,546	$41.96	$9,211,315	9,280	$62.51	$580,112	120,557	$30.53	$3,680,605
New Mexico	112,454	22.68	2,550,612	4,946	40.79	201,726	20,374	31.08	633,224
Arizona	106,605	25.50	2,718,271	3,923	47.77	187,385	19,233	35.50	682,772
Utah	104,256	39.05	4,071,521	2,064	32.20	66,461	72,791	31.12	2,270,858
Nevada	76,620	42.62	3,265,645	2,239	50.13	112,252	16,655	37.56	625,562
Idaho	145,195	43.44	6,307,422	1,582	56.52	89,416	59,620	30.35	1,809,467
Washington	225,755	63.10	14,244,307	2,435	65.97	160,625	159,088	31.31	4,981,045
Oregon	215,017	54.42	11,700,376	6,805	63.15	429,762	138,923	27.59	3,832,886
California	363,339	67.48	24,518,741	66,361	76.39	5,069,044	354,559	36.57	12,966,223
Oklahoma	354,976	52.68	18,701,121	62,409	73.79	4,605,362	186,730	19.35	3,613,400
Indian Territory	193,849	41.01	7,949,206	44,707	73.99	3,308,022	99,418	24.67	2,452,642
United States	17,057,702	70.37	1,200,310,020	2,888,710	87.18	251,840,378	17,572,464	27.44	482,272,203

State or Territory.	Other cattle.			Sheep.			Hogs.		
	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.
Maine	121,216	$16.16	$1,959,191	270,025	$3.02	$815,043	64,701	$9.45	$611,424
New Hampshire	104,254	16.31	1,700,182	75,997	3.22	245,158	50,220	9.44	474,077
Vermont	225,870	14.37	3,246,605	214,445	3.28	703,680	90,405	7.85	709,679
Massachusetts	92,447	16.72	1,546,073	40,818	3.86	157,533	71,920	11.28	811,258
Rhode Island	10,444	17.71	184,939	8,216	4.11	33,748	12,569	12.22	153,593
Connecticut	85,748	17.33	1,485,702	33,569	4.19	140,500	46,036	12.00	552,432
New York	917,574	16.19	14,[illegible]5,158	985,480	4.07	4,009,525	675,613	8.36	5,648,125
New Jersey	79,599	20.00	1,591,732	43,344	4.36	188,841	150,988	10.40	1,570,275
Pennsylvania	774,496	15.95	12,350,887	895,982	3.81	3,415,394	980,089	8.28	8,115,062
Delaware	20,962	17.44	365,614	10,512	3.92	41,239	45,128	7.89	356,060
Maryland	133,979	17.69	2,369,928	147,208	3.66	538,267	2[illegible]0,324	7.41	2,151,301
Virginia	431,827	16.60	7,166,172	452,128	3.10	1,403,813	767,163	4.97	3,812,800
North Carolina	301,524	10.37	3,126,860	209,118	1.99	415,727	1,058,146	4.85	5,132,008
South Carolina	173,071	10.92	1,890,053	58,857	2.05	120,374	664,907	5.52	3,670,287
Georgia	629,139	10.28	6,467,927	273,893	1.81	496,102	1,396,922	5.14	7,180,179
Florida	512,075	9.12	4,671,966	108,736	1.95	212,177	383,741	3.49	1,339,256
Alabama	367,972	7.82	2,876,660	189,900	1.65	312,424	1,034,092	4.53	4,684,437
Mississippi	389,281	8.22	3,191,832	183,739	1.57	287,736	1,087,780	4.80	5,221,344
Louisiana	400,896	9.78	3,922,363	174,888	1.79	313,907	655,866	4.78	3,135,039
Texas	8,249,749	10.09	83,260,593	1,617,125	2.08	3,356,344	2,525,048	4.68	11,817,225
Arkansas	473,654	7.54	3,570,070	204,665	1.60	327,075	1,031,245	3.63	3,743,419
Tennessee	424,886	10.94	4,650,169	297,374	2.27	676,288	1,011,516	4.70	4,754,125
West Virginia	338,305	19.73	6,674,865	512,671	3.19	1,635,061	306,459	5.33	1,633,426
Kentucky	512,989	15.54	7,972,828	654,999	2.75	1,800,594	1,185,636	3.99	4,730,688
Ohio	1,096,607	19.56	21,451,600	2,601,010	3.41	8,865,284	2,701,250	6.30	17,017,875
Michigan	699,914	14.32	10,019,412	1,759,675	3.50	6,163,789	920,447	6.67	6,139,381
Indiana	985,141	19.56	19,266,209	1,134,771	3.81	4,320,074	2,631,470	5.77	15,183,582
Illinois	1,666,872	20.74	34,573,093	705,358	4.27	3,010,821	3,747,120	6.74	25,255,589
Wisconsin	1,148,583	13.68	15,714,448	921,632	3.26	3,007,838	1,653,316	7.78	12,862,798
Minnesota	941,806	11.18	10,529,203	385,003	3.12	1,202,558	1,268,561	7.05	8,943,355
Iowa	3,467,507	19.42	67,348,010	698,316	3.80	2,652,485	7,290,624	6.71	48,920,094

Number, average price, and value of farm animals in the United States in 1904—Continued.

State or Territory.	Other cattle.			Sheep.			Hogs.		
	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.	Number.	Average price per head.	Value.
Missouri	1,490,089	$17.21	$25,642,496	770,340	$3.13	$2,409,624	3,110,582	$4.50	$13,997,619
Kansas	2,682,299	17.21	46,159,947	229,001	3.10	709,583	1,949,782	6.25	12,186,138
Nebraska	2,379,478	17.34	41,249,675	419,339	2.98	1,248,666	2,888,344	6.51	18,806,374
South Dakota	1,470,563	16.59	24,389,434	806,704	2.99	2,413,095	836,824	6.63	5,548,143
North Dakota	598,705	16.47	9,858,878	702,290	3.08	2,159,823	191,540	7.37	1,411,650
Montana	1,048,455	18.42	19,314,006	5,638,967	2.94	16,551,495	57,592	8.11	467,071
Wyoming	812,061	21.33	17,321,264	3,267,887	2.46	8,034,754	15,665	8.05	126,103
Colorado	1,273,180	17.53	22,322,790	1,458,749	2.68	3,911,344	77,357	7.22	558,518
New Mexico	851,968	13.84	11,788,682	2,856,745	1.98	5,656,356	21,126	5.80	122,531
Arizona	512,294	16.11	8,252,594	816,141	2.55	2,083,771	18,184	7.44	135,289
Utah	254,301	16.69	4,243,297	2,344,108	2.52	5,908,558	56,250	7.62	428,625
Nevada	390,020	16.49	6,429,481	1,345,791	2.51	3,378,608	14,157	8.47	119,910
Idaho	358,251	16.39	5,871,095	2,978,068	2.62	7,796,285	113,703	7.05	801,606
Washington	306,438	16.27	4,986,606	849,618	2.65	2,253,017	174,128	7.68	1,337,303
Oregon	581,501	14.69	8,544,232	2,546,662	2.30	5,868,274	268,933	6.06	1,629,734
California	1,122,218	19.29	21,648,258	2,180,399	2.67	5,824,718	521,384	6.10	3,180,442
Oklahoma	1,284,399	13.32	17,102,925	63,600	2.79	177,508	496,343	5.47	2,714,996
Indian Territory	474,841	13.57	6,445,304	26,560	2.90	76,978	708,823	4.73	3,352,733
United States	43,669,443	15.15	661,571,308	45,170,423	2.82	127,331,850	47,320,511	5.99	283,254,978

LOSSES OF FARM ANIMALS.

Estimated losses of farm animals during the year ended March 31, 1905.

[From Bureau of Statistics, Department of Agriculture.]

State or Territory.	Horses.		Cattle.			Sheep.			Hogs.	
	Per cent.	Number.	From exposure.	From disease.	From all causes.	From exposure.	From disease.	From all causes.	Per cent.	Number.
			Per ct.	*Per ct.*	*Number.*	*Per ct.*	*Per ct.*	*Number.*		
Maine	1.7	2,315	0.4	1.2	4,965	1.1	3.8	13,231	1.2	776
New Hampshire	1.5	954	.5	1.6	4,917	2.4	2.0	3,344	2.2	1,105
Vermont	1.5	1,363	.1	1.5	8,179	.4	2.0	5,147	1.8	1,627
Massachusetts	1.6	2,290	.2	1.5	4,812	.5	1.4	775	2.0	1,438
Rhode Island	1.2	189	.0	1.3	467	.0	1.0	82	2.2	277
Connecticut	2.8	1,624	.0	1.7	3,682	.4	3.2	1,208	2.3	1,059
New York	1.7	10,839	.4	1.9	60,699	.6	2.7	32,521	1.7	14,485
New Jersey	1.7	1,603	.7	2.3	7,927	.7	2.5	1,387	2.2	3,322
Pennsylvania	1.8	10,935	.4	1.7	39,086	1.3	2.8	36,735	2.3	22,542
Delaware	3.7	1,298	1.8	4.1	3,310	3.3	2.6	620	4.3	1,941
Maryland	1.7	2,443	1.3	1.4	7,598	2.7	2.6	7,802	4.3	12,484
Virginia	1.8	4,725	1.4	1.8	21,906	2.5	3.4	26,675	4.3	32,988
North Carolina	2.0	3,281	1.8	2.1	19,305	2.7	3.3	12,547	9.7	102,640
South Carolina	3.0	2,242	2.4	2.7	14,442	3.5	3.1	3,885	8.5	56,517
Georgia	2.5	3,079	2.9	2.0	44,416	5.1	2.9	21,912	5.1	71,243
Florida	2.9	1,375	3.1	3.7	40,738	6.0	3.2	10,004	8.2	31,467
Alabama	2.4	3,546	3.0	2.8	34,690	3.3	2.9	11,774	5.7	58,943
Mississippi	2.4	6,053	4.6	2.9	49,596	6.8	3.7	19,292	6.9	75,057
Louisiana	3.5	6,407	8.9	4.9	78,276	7.8	4.3	21,161	11.3	74,113

Estimated losses of farm animals during the year ended March 31, 1905—Continued.

State or Territory.	Horses.		Cattle.			Sheep.			Hogs.	
	Per cent.	Number.	From exposure.	From disease.	From all causes.	From exposure.	From disease.	From all causes.	Per cent.	Number.
			Per ct.	*Per ct.*	*Number.*	*Per ct.*	*Per ct.*	*Number.*		
Texas	2.7	34,500	5.7	2.7	763,407	4.6	3.1	124,519	5.5	138,878
Arkansas	2.1	5,322	4.3	3.5	58,852	5.0	3.4	17,192	12.2	125,812
Tennessee	2.0	5,447	2.2	2.6	33,956	3.1	3.4	19,330	7.3	73,841
West Virginia	1.7	2,874	1.6	1.8	17,635	2.3	3.3	28,709	3.6	11,033
Kentucky	2.0	7,907	1.9	2.3	33,587	3.3	4.0	47,815	6.3	74,695
Ohio	1.2	9,431	.5	1.3	33,972	1.3	2.3	93,636	3.8	102,648
Michigan	1.6	8,856	2.3	1.5	47,730	1.1	2.6	65,108	2.5	23,011
Indiana	1.5	9,542	.6	1.5	32,187	1.3	2.3	40,852	5.4	142,099
Illinois	1.6	19,717	.6	1.5	55,909	1.0	2.2	22,572	4.6	172,368
Wisconsin	1.7	9,648	.8	1.7	56,112	1.1	1.9	27,649	2.2	36,373
Minnesota	2.0	13,774	.8	1.7	44,466	1.0	1.9	11,165	2.1	26,640
Iowa	1.4	16,022	1.1	1.7	134,494	1.4	2.6	27,932	4.2	306,206
Missouri	1.7	13,768	1.8	2.4	86,515	2.5	3.1	43,139	7.4	230,183
Kansas	1.2	10,568	1.9	1.5	114,022	1.7	1.3	6,870	3.4	66,293
Nebraska	1.5	11,933	1.6	2.3	118,904	3.3	1.9	21,805	4.6	132,887
South Dakota	1.4	6,542	1.5	2.1	67,402	1.8	2.7	36,302	2.3	19,247
North Dakota	1.4	5,484	1.4	1.8	25,378	2.9	1.9	33,710	1.3	2,490
Montana	1.6	3,788	2.4	1.8	46,347	3.8	2.0	327,060	1.1	634
Wyoming	3.0	3,037	3.0	1.3	35,786	5.1	2.4	245,091	1.9	298
Colorado	1.9	4,171	2.7	1.9	64,112	3.6	2.5	88,984	2.4	1,857
New Mexico	3.6	4,048	7.4	1.8	80,255	8.7	2.9	331,383	1.8	380
Arizona	1.7	1,812	4.2	1.5	30,297	1.8	1.6	27,749	9.4	1,709
Utah	2.1	2,189	1.8	2.2	13,091	2.7	2.1	112,517	1.4	788
Nevada	1.5	1,149	1.1	2.5	14,640	1.5	4.4	79,402	2.1	297
Idaho	2.0	2,904	2.2	1.9	17,133	2.6	2.1	139,969	1.1	1,251
Washington	2.2	4,967	1.7	1.7	15,828	2.8	2.0	40,781	1.6	2,786
Oregon	1.7	3,655	2.3	1.4	26,656	2.2	1.8	101,867	1.5	4,034
California	1.6	5,813	1.1	2.6	54,641	2.3	2.2	98,118	3.3	17,206
Oklahoma	1.9	6,745	3.3	2.0	77,970	4.0	5.4	5,978	2.3	11,416
Indian Territory	2.0	3,877	3.2	3.2	36,752	4.4	1.1	1,461	16.0	113,412
United States	1.8	306,051	2.3	2.1	2,687,027	3.1	2.5	2,498,767	5.1	2,401,796

WOOL PRODUCT OF THE UNITED STATES, 1903 AND 1904.

[These statistics are from the Bulletin of the National Association of Wool Manufacturers. The number of sheep for 1904 does not agree with the report by the Bureau of Statistics, but the one was estimated on April 1, while the other was at the end of the year.—EDITOR.]

State or Territory.	Number of sheep.[a]	Average weight of fleece.	Shrinkage.	Wool, washed and unwashed.	Value.
1903.		*Pounds.*	*Per cent.*	*Pounds.*	
Maine	230,000	6.0	40	1,380,000	$347,760
New Hampshire	63,000	6.2	50	390,600	82,026
Vermont	160,000	6.0	50	960,000	201,600
Massachusetts	33,000	5.8	45	191,400	44,213
Rhode Island	6,500	5.5	42	35,750	8,709
Connecticut	30,000	5.0	40	150,000	37,800
New York	700,000	6.0	50	4,200,000	1,008,000
New Jersey	32,000	5.0	47	160,000	35,616
Pennsylvania	850,000	6.0	52	5,100,000	1,297,440
Delaware	6,500	6.0	50	39,000	8,190
Maryland	100,000	5.0	47	500,000	111,300
West Virginia	475,000	5.3	46	2,517,500	856,454
Kentucky	600,000	4.75	38	2,850,000	742,140
Ohio	2,200,000	5.6	52	12,320,000	3,134,208
Michigan	1,400,000	6.5	50	9,100,000	2,229,500
Indiana	750,000	6.5	50	4,875,000	1,121,250
Illinois	550,000	7.0	52	3,850,000	831,600
Wisconsin	750,000	6.5	48	4,875,000	1,135,750
Minnesota	350,000	6.8	52	2,380,000	491,232
Iowa	600,000	6.5	50	3,900,000	955,500
Missouri	575,000	6.5	50	3,737,000	840,938
Virginia	325,000	4.5	38	1,462,500	408,038
North Carolina	205,000	4.0	42	820,000	199,752
South Carolina	50,000	4.0	42	200,000	48,720
Georgia	250,000	3.8	40	950,000	239,400
Florida	100,000	3.8	42	380,000	92,568
Alabama	200,000	3.7	40	740,000	186,480
Mississippi	230,000	4.0	42	920,000	224,112
Louisiana	155,000	3.7	45	573,500	134,478
Arkansas	160,000	4.0	42	640,000	155,904
Tennessee	275,000	4.5	40	1,237,500	311,850
Kansas	170,000	7.5	67	1,275,000	193,545
Nebraska	300,000	7.5	67	2,250,000	341,550
South Dakota	600,000	6.5	60	3,900,000	764,400
North Dakota	475,000	6.5	60	3,087,500	605,150
Montana	5,100,000	6.0	63	30,600,000	5,547,780
Wyoming	4,100,000	7.0	68	28,700,000	4,500,160
Idaho	2,400,000	7.0	67	16,800,000	2,716,560
Washington	560,000	8.5	70	4,760,000	699,720
Oregon	2,000,000	7.75	70	15,500,000	2,418,000

[a] The estimate of sheep was made on April 1 of each year.

Wool product of the United States, 1903 and 1904—Continued.

State or Territory.	Number of sheep.	Average weight of fleece.	Shrinkage.	Wool, washed and unwashed.	Value.
1903.		*Pounds.*	*Per cent.*	*Pounds.*	
California	1,625,000	7.25	68	11,781,250	$1,885,000
Nevada	568,000	7.0	70	3,976,000	620,256
Utah	2,250,000	5.75	64	12,937,500	2,282,175
Colorado	1,300,000	6.5	66	8,450,000	1,292,850
Arizona	675,000	6.5	67	4,387,500	709,459
New Mexico	3,250,000	5.0	60	16,250,000	2,925,000
Texas	1,440,000	6.25	68	9,000,000	1,497,600
Oklahoma and Indian Territory	60,000	6.0	68	360,000	51,840
Total fleece wool	39,284,000	6.25	60.8	245,450,000	46,571,573
Total pulled wool	....	....	....	42,000,000	12,203,800
Total product	....	....	....	287,450,000	58,775,373
1904.					
Maine	230,000	6.0	40	1,380,000	414,000
New Hampshire	63,000	6.2	50	390,600	97,650
Vermont	160,000	6.0	50	960,000	240,000
Massachusetts	30,000	5.8	45	174,000	48,750
Rhode Island	6,500	5.5	42	35,750	10,388
Connecticut	30,000	5.0	40	150,000	45,000
New York	675,000	6.0	50	4,050,000	1,113,750
New Jersey	32,000	5.0	47	160,000	42,400
Pennsylvania	850,000	6.0	52	5,100,000	1,419,840
Delaware	6,500	6.0	50	39,000	9,750
Maryland	100,000	5.0	47	500,000	132,500
West Virginia	475,000	5.3	46	2,517,500	883,642
Kentucky	575,000	5.0	38	2,875,000	891,250
Ohio	2,033,072	6.0	52	12,198,432	3,396,043
Michigan	1,200,000	6.5	50	7,800,000	2,145,000
Indiana	700,000	6.5	50	4,550,000	1,205,750
Illinois	525,000	7.25	52	3,806,250	950,040
Wisconsin	700,000	6.75	48	4,525,000	1,223,560
Minnesota	350,000	7.0	52	2,450,000	588,000
Iowa	540,000	6.5	50	3,510,000	965,250
Missouri	575,000	6.5	49	3,737,500	891,185
Virginia	335,000	4.5	38	1,507,500	486,018
North Carolina	205,000	4.0	42	820,000	237,800
South Carolina	50,000	4.0	42	200,000	58,000
Georgia	250,000	3.8	40	950,000	285,000
Florida	100,000	3.5	40	350,000	105,000
Alabama	200,000	3.5	40	700,000	210,000
Mississippi	230,000	4.0	42	920,000	266,800
Louisiana	155,000	3.7	45	573,500	157,712
Arkansas	200,000	4.0	42	800,000	232,000
Tennessee	260,000	4.25	40	1,105,000	331,500
Kansas	170,000	8.0	68	1,360,000	226,304
Nebraska	250,000	8.0	68	2,000,000	332,800
South Dakota	575,000	6.75	60	3,881,250	822,825
North Dakota	450,000	6.5	60	2,925,000	620,100
Montana	5,576,000	6.75	64	37,773,000	7,479,054
Wyoming	3,800,000	7.75	70	29,450,000	4,859,250
Idaho	2,300,000	6.5	65	14,950,000	2,877,875
Washington	560,000	8.0	68	4,480,000	759,808
Oregon	2,000,000	7.25	69	14,500,000	2,472,250

Wool product of the United States, 1903 and 1904—Continued.

State or Territory.	Number of sheep.	Average weight of fleece.	Shrinkage.	Wool, washed and unwashed.	V ue.
1904.		*Pounds.*	*Per cent.*	*Pounds.*	
California	1,625,000	7.25	68	11,781,250	$1,998,100
Nevada	600,000	7.0	70	4,200,000	718,200
Utah	2,025,000	6.5	67	13,162,500	2,378,549
Colorado	1,300,000	7.0	68	9,100,000	1,514,240
Arizona	620,000	7.0	69	4,340,000	713,062
New Mexico	3,150,000	5.5	64	17,325,000	3,168,500
Texas	1,440,000	6.5	68	9,360,000	1,707,264
Oklahoma and Indian Territory	60,000	6.0	68	360,000	57,600
Total fleece wool	38,342,072	6.5	61.6	249,783,032	51,789,359
Total pulled wool			33	42,000,000	13,151,600
Total product				291,783,032	64,940,959

LIVE-STOCK ASSOCIATIONS AND THE MARKETS.

REGISTERED LIVE STOCK IN THE UNITED STATES DECEMBER 31, 1904.

In the Twentieth Annual Report of the Bureau of Animal Industry a statement was published showing the number of domestic animals registered in recognized American pedigree records on December 31 preceding, together with an estimate of the number of registered animals living on that date. These figures were compiled from reports submitted by secretaries of the various associations and from published pedigree records. Using them as a basis, estimates were made of the proportion of the total number of animals of each class, which were registered and living on the above date, as follows:

	Per cent.
Horses	0.94
Dairy cattle	2.00
Beef ("other") cattle	.84
Sheep	.47
Hogs	.29

The estimate for dairy cattle was that of Maj. Henry E. Alvord, late chief of the Dairy Division of this Bureau.

The intention in compiling these figures is to develop a basis on which to work to reach an intelligent estimate of the relation of pure-bred live stock to the total number. The cooperation of herdbook officials has been solicited and the requests of the Bureau have generally been replied to promptly and cordially. As a continuation of the first year's estimates, figures for the calendar year ended December 31, 1904, were called for and are presented below. In a few cases no replies were received, and in such instances the estimates for the preceding year have been used or the figures of the latest published volume of the book of record in question.

Making allowances[a] for associations and breeds from which no replies were received or which were incomplete, the total number of

[a] Horses allowed, 9,000; dairy cattle, 193,000; beef cattle, 20,000; sheep, 67,000; hogs, 6,000. These estimates were made by taking the sum of registered animals for which estimates were not furnished and calculating the number of living animals as approximately one-half of the total number registered with horses and beef cattle and one-fourth with sheep and hogs. It will be noticed that this is rather smaller than the estimates generally furnished by the secretaries. In estimating the number of registered beef cattle this term was used to include all breeds of cattle but the Ayrshire, Dutch Belted, Guernsey, Holstein-Friesian, and Jersey.

registered domestic animals in the United States living on December 31, 1904, was approximately as follows:

Horses	185,000
Dairy cattle	224,000
Beef ("other") cattle	452,000
Sheep	222,000
Hogs	181,000

Using the estimates of the Bureau of Statistics of this Department as a basis, we find the relative number of registered animals living on December 31, 1904, as follows:

	Per cent.
Horses	1.08
Dairy cattle	1.27
Beef ("other") cattle	1.04
Sheep	.49
Hogs	.38

In round numbers, then, about 1 per cent of the horses and beef cattle in the country are purebred and registered, 1¼ per cent of the dairy cattle, and one-half of 1 per cent of the sheep and hogs. In the Eastern States and in the corn belt these percentages are doubtless considerably higher.

The figures given are not strictly comparable with those for 1903. In the former case the reports of the Twelfth Census were used as the basis, whereas in the present one the estimates of the Bureau of Statistics of this Department are used.

The thanks of the Bureau are due those secretaries who furnished estimates.

Registered live stock in the United States on December 31, 1904.

[Mainly compiled from estimates and statements furnished by the secretaries of the pedigree record associations.]

Breed.	Book of record.	Animals registered Dec. 31, 1904.			Registered animals living Dec. 31, 1904.		
		Male.	Female.	Total.	Male.	Female.	Total.
HORSES.		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
American Trotter	American Trotting Register	40,000	104,300	144,500	76,000	70,000	96,000
Morgan	American Morgan Register	[a] 5,021	2,800	7,821	3,765	2,100	5,865
American Saddle Horse	American Saddle Horse Register	[a] 2,359	3,247	5,606	1,200	1,500	2,700
Thoroughbred	American Studbook	....	....	42,000	....	....	25,000
Cleveland Bay	American Cleveland Bay Studbook	1,205	470	1,675	1,000	400	1,400
German Coach	German, Hanoverian, and Oldenburg Coach Horse Studbook	[b] 1,126	[b] 141	[b] 1,267	....	....	[b] 1,000
German Coach (Oldenburg)	Oldenburg Coach Horse Register	217	27	244	No accurate data.		
Hackney	American Hackney Studbook	726	1,542	2,268	684	1,416	2,100
Shetland Pony	American Shetland Pony Club Studbook	1,777	3,555	5,332	1,600	2,500	4,100
Belgian Draft	American Register of Belgian Draft Horses	1,787	227	2,014	1,786	227	2,013
Clydesdale	American Clydesdale Studbook	....	....	[c] 11,000	....	....	....
French Draft	National Register of French Draft Horses	8,393	4,557	12,950	....	....	5,000
Percheron	American Percheron Studbook	540	460	1,000	18,540	11,460	30,000
Do	Percheron Register	295	17	312	290	13	303
Shire	American Shire Horse Studbook	5,663	2,007	7,670	No accurate data.		
Suffolk	American Suffolk Horse Studbook	147	66	213	100	50	150
ASSES.							
Jacks and jennets	American Jack Stock Studbook	800	600	1,400	No accurate data.		
CATTLE.							
Aberdeen-Angus	American Aberdeen Angus Herdbook	33,372	42,472	75,844	24,200	30,800	55,000
Galloway	American Galloway Herdbook	9,581	15,969	25,550	7,160	5,690	12,850
Hereford	American Hereford Record	100,645	100,645	201,290	50,000	50,000	100,000
Shorthorn	American Shorthorn Herdbook	231,405	366,425	597,830	77,100	165,000	242,100
Sussex	American Sussex Register	70	172	242	40	85	125

[a] Includes geldings. [b] Estimate for 1903. [c] Registrations to close of Vol. XI, 1904.

Registered live stock in the United States on December 31, 1904—Continued.

Breed.	Book of record.	Animals registered Dec. 31, 1904.			Registered animals living Dec. 31, 1904.		
		Male.	Female.	Total.	Male.	Female.	Total.
CATTLE—continued.		*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Brown Swiss	Swiss Record	2,007	2,879	4,886	1,338	1,919	3,257
Devon	American Devon Record	7,816	13,472	21,288	4,000	8,500	12,500
Polled Durham	American Polled Durham Herdbook	4,878	5,885	10,763	2,926	3,528	6,454
Red Polled	Red Polled Herdbook	13,650	26,716	40,366	No accurate data.		
Ayrshire	Ayrshire Record	9,168	19,763	28,931	3,000	9,000	12,000
Dutch Belted	Dutch Belted Cattle Herdbook	532	1,208	1,740	...	...	650
Guernsey	Herd Register of the American Guernsey Cattle Club	9,836	18,216	28,052	6,000	12,000	18,000
Holstein Friesian	Holstein Friesian Herdbook	42,682	88,180	130,862	No accurate data.		
Jersey	Herd Register of the American Jersey Cattle Club	69,267	186,297	255,564	No accurate data.		
SHEEP.							
Merino (Delaine)	Black Top Spanish Merino Sheep Register	5,054	11,259	16,313	1,500	3,000	4,500
Do	Dickinson Spanish Merino Sheep Register	...	...	9,000	...	...	7,000
Do	Improved Delaine Merino Register	8,000	12,000	20,000	3,000	7,000	10,000
Do	National Delaine Merino Register	6,674	11,324	17,998	1,500	5,000	6,500
Merino (French)	American Rambouillet Record	...	...	[a]27,834	[a]8,000	[a]12,000	[a]20,000
Merino (German)	International Von Homeyer Rambouillet Club Record	112	140	252	50	130	180
Merino (Spanish)	Register of the Michigan Merino Sheep Breeders' Association	12,500	37,500	50,000	500	4,300	5,000
Do	Register of the New York State American Merino Sheep Breeders' Association.	...	...	19,625	275	1,825	2,100
Do	Register of the Standard American Merino Register Association	No accurate data.			50	150	200
Do	Register of the Vermont Merino Sheep Breeders' Association	...	...	219,066	No accurate data.		
Cheviot	Flock Book of the American Cheviot Sheep Society	...	...	10,332	2,500	500	3,000
Dorset Horn	Flock Book of the Continental Dorset Club	1,134	3,100	4,234	850	2,325	3,175
Hampshire Down	Hampshire Down Flock Record	4,900	11,501	16,401	No accurate data.		
Oxford Down	American Oxford Record	...	...	32,798	No accurate data.		
Shropshire	American Shropshire Sheep Record	50,000	158,360	208,360	15,000	45,000	60,000
Southdown	American Southdown Record	...	...	18,690	...	...	9,345

Suffolk	Register of the American Suffolk Flock Registry Association			905			500
Cotswold	American Cotswold Record			32,705			12,000
Leicester	American Leicester Record	3,135	4,944	8,079	2,633	4,153	6,786
Lincoln	Register of the National Lincoln Sheep Breeders' Association	5,500	7,140	12,640	4,000	5,000	9,000
HOGS.							
Berkshire	American Berkshire Record			80,920			27,000
Cheshire	Cheshire Herdbook	1,200	2,088	3,288	300	600	900
Chester White	American Chester White Record			a 11,911	a 489	a 1,307	a 1,796
Chester, Ohio Improved	Ohio Improved Chester Record			9,688	1,800	4,000	5,800
Duroc-Jersey	American Duroc Jersey Record	7,074	16,310	23,384	No accurate data.		
Do	National Duroc Jersey Record	16,750	41,000	57,750	4,187	10,250	14,437
Hampshire (Thin Rind)	American Hampshire Record	218	454	672	95	310	405
Poland China	American Poland China Record	46,407	116,484	162,891	20,000	50,000	70,000
Do	Ohio Poland China Record	31,250	70,000	101,250	9,000	21,000	30,000
Do	Southwestern Poland China Record	609	904	1,513	500	650	1,150
Do	Standard Poland China Record	35,838	85,052	120,890	5,364	12,677	18,041
Tamworth	Record of the American Tamworth Swine Record Association			1,949			1,200
Yorkshire, Large Improved.	Register of the American Yorkshire Club	2,457	3,079	5,536	2,000	2,600	4,600

a Estimate for 1903.

PEDIGREE RECORD ASSOCIATIONS IN THE UNITED STATES.

Paragraph 473 of the tariff act of July 24, 1897 (amended March 3, 1903), provides that—

Any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, whether intended to be so used by the importer himself or for sale for such purpose: *Provided,* That no such animal shall be admitted free unless pure bred of a recognized breed, and duly registered in the books of record established for that breed: *And provided further,* That certificate of such record and of the pedigree of such animal shall be produced and submitted to the customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in said certificate of record of pedigree: *And provided further,* That the Secretary of Agriculture shall determine and certify to the Secretary of the Treasury what are recognized breeds and purebred animals under the provisions of this paragraph.

Accordingly, the Department of Agriculture has certified a large number of books of record of pedigrees and their publishing agencies, and has prescribed regulations for them which have been published in B. A. I. Order No. 130.[a] The list of certified associations has been published in this order and in various publications of the Agricultural and Treasury Departments. The certified American books of record are given below, together with the names of the associations publishing them and the names and addresses of the publishing officers. This list has been corrected to January 30, 1905:

CATTLE.

Name of breed.	Book of record.	By whom published.
Aberdeen Angus	American Aberdeen Angus Herdbook.	American Aberdeen Angus Breeders' Association, Thos. McFarlane, secretary, Union Stock Yards, Chicago, Ill.
Ayrshire	Ayrshire Record	Ayrshire Breeders' Association, C. M. Winslow, secretary, Brandon, Vt.
Devon	American Devon Record	American Devon Cattle Club, L. P. Sisson, secretary, Newark, Ohio.
Dutch Belted	Dutch Belted Cattle Herdbook.	Dutch Belted Cattle Association of America, H. B. Richards, secretary, Easton, Pa.
Galloway	American Galloway Herdbook.	American Galloway Breeders' Association, C. W. Gray, secretary, Union Stock Yards, Chicago, Ill.
Guernsey	Herd Register of the American Guernsey Cattle Club.	American Guernsey Cattle Club, William H. Caldwell, secretary, Peterboro, N. H.
Hereford	American Hereford Record	American Hereford Cattle Breeders' Association, C. R. Thomas, secretary, 225 West Twelfth street, Kansas City, Mo.
Holstein Friesian	Holstein Friesian Herdbook	Holstein Friesian Association of America, Frederick L. Houghton, secretary, Brattleboro, Vt.
Jersey	Herd Register of the American Jersey Cattle Club.	American Jersey Cattle Club, J. J. Hemingway, secretary, 8 West Seventeenth street, New York, N. Y.
Polled Durham	American Polled Durham Herdbook.	The Polled Durham Breeders' Association, Fletcher S. Hines, secretary, Indianapolis, Ind.

[a] See p. 594.

CATTLE—Continued.

Name of breed.	Book of record.	By whom published.
Red Polled	Red Polled Herdbook	Red Polled Cattle Club of America (Incorporated), J. McLain Smith, secretary, Dayton, Ohio.
Shorthorn	American Shorthorn Herdbook.	American Shorthorn Breeders' Association, John W. Groves, secretary, Union Stock Yards, Chicago, Ill.
Sussex	American Sussex Register	American Sussex Association, Overton Lea, secretary, Nashville, Tenn.
Brown Swiss	Swiss Record	Brown Swiss Cattle Breeders' Association, C. D. Nixon, secretary, Owego, N. Y.

HORSES.

Name of breed.	Book of record.	By whom published.
American Trotter	American Trotting Register	American Trotting Register Association, Wm. H. Knight, secretary, 355 Dearborn street, Chicago, Ill.
Belgian Draft	American Register of Belgian Draft Horses.	American Association of Importers and Breeders of Belgian Draft Horses, J. D. Conner, jr., secretary, Wabash, Ind.
Cleveland Bay	American Cleveland Bay Studbook.	Cleveland Bay Society of America, R. P. Stericker, secretary, 80 Chestnut avenue, West Orange, N. J.
Clydesdale	American Clydesdale Studbook.	American Clydesdale Association, R. B. Ogilvie, secretary, Union Stock Yards, Chicago, Ill.
French Coach	French Coach Studbook	French Coach Horse Society of America, Duncan E. Willett, secretary, 2112 Michigan avenue, Chicago, Ill.
French Draft	National Register of French Draft Horses.	National French Draft Horse Association, C. E. Stubbs, secretary, Fairfield, Iowa.
German Coach [a]	German, Hanoverian, and Oldenburg Coach Horse Studbook.	German, Hanoverian, and Oldenburg Coach Horse Association of America, J. Crouch, secretary, Lafayette, Ind.
Hackney	American Hackney Studbook.	American Hackney Horse Society, A. H. Godfrey, secretary, P. O. Box 111, Madison Square, New York, N. Y.
Morgan	American Morgan Register	American Morgan Register Association, H. C. Shaw, recording secretary, Middlebury, Vt.
Oldenburg [b]	Oldenburg Coach Horse Register.	Oldenburg Coach Horse Association of America, C. E. Stubbs, secretary, Fairfield, Iowa.
Percheron	American Percheron Studbook.	American Percheron Horse Breeders' and Importers' Association, Geo. W. Stubblefield, secretary, Union Stock Yards, Chicago, Ill.
Do	Percheron Register	The Percheron Registry Co., Chas. C. Glenn, secretary, Columbus, Ohio.
Saddle Horse	American Saddle Horse Register.	American Saddle Horse Breeders' Association, I. B. Nall, secretary, Louisville, Ky.
Shetland Pony	American Shetland Pony Club Studbook.	American Shetland Pony Club, Mortimer Levering, secretary, Lafayette, Ind.
Shire	American Shire Horse Studbook.	American Shire Horse Association, Charles Burgess, secretary, Wenona, Ill.
Suffolk	American Suffolk Horse Studbook.	American Suffolk Horse Association, Alex. Galbraith, secretary, Janesville, Wis.
Thoroughbred	American Studbook	The Jockey Club, James E. Wheeler, registrar, 571 Fifth avenue, New York, N. Y.

[a] See Oldenburg. [b] See German Coach.

ASSES.

Name of breed.	Book of record.	By whom published.
Jacks and jennets.	American Jack Stock Stud-book.	American Breeders' Association of Jacks and Jennets, J. W. Jones, secretary, Columbia, Tenn.

SHEEP.

Cheviot	American Cheviot Sheep Flock Book.	American Cheviot Sheep Society, F. E. Dawley, secretary, Fayetteville, N. Y.
Cotswold	American Cotswold Record	American Cotswold Registry Association, F. W. Harding, secretary, Waukesha, Wis.
Dorset Horn	Continental Dorset Sheep Record.	The Continental Dorset Club, J. E. Wing, secretary, Mechanicsburg, Ohio.
Hampshire Down	Hampshire Down Flock Record.	Hampshire Down Breeders' Association of America, Comfort A. Tyler, secretary, Nottawa, Mich.
Leicester	American Leicester Record	American Leicester Breeders' Association, A. J. Temple, secretary, Cameron, Ill.
Lincoln	National Lincoln Sheep Breeders' Record.	National Lincoln Sheep Breeders' Association, Bert Smith, secretary, Charlotte, Mich.
Merino (Delaine)	Black Top Spanish Merino Sheep Register.	Black Top Spanish Merino Sheep Breeders' Publishing Association, R. P. Berry, secretary, R. F. D. No. 3, Eightyfour, Pa.
Do	Dickinson Spanish Merino Sheep Register.	Dickinson Merino Sheep Record Co., H. G. McDowell, secretary, Canton, Ohio.
Do	Improved Delaine Merino Register.	Improved Delaine Merino Sheep Breeders' Association, George A. Henry, secretary, R. F. D. No. 8, Bellefontaine, Ohio.
Do	National Delaine Merino Register.	National Delaine Merino Sheep Breeders' Association, J. B. Johnson, recording secretary-treasurer, Canonsburg, Pa.
Merino (French)	American Rambouillet Record.	American Rambouillet Sheep Breeders' Association, Dwight Lincoln, secretary, Milford Center, Ohio.
Merino (German)	International Von Homeyer Rambouillet Club Record.	International Von Homeyer Rambouillet Club, E. M. Moore, secretary, Orchard Lake, Mich.
Merino (Spanish)	Register of the Michigan Merino Sheep Breeders' Association.	Michigan Merino Sheep Breeders' Association, E. N. Ball, secretary, Hamburg, Mich.
Do	Register of the New York State American Merino Sheep Breeders' Association.	New York State American Merino Sheep Breeders' Association, J. H. Earll, secretary, Skaneateles, N. Y.
Do	Register of the Ohio Spanish Merino Sheep Breeders' Association.	Ohio Spanish Merino Sheep Breeders' Association, Wesley Bishop, secretary, R. F. D. No. 1, Delaware, Ohio.
Do	Register of the Standard American Merino Register Association.	Standard American Merino Sheep Breeders' Association, J. P. Ray, secretary, Allenshill, N. Y.
Do	Register of the Vermont Merino Sheep Breeders' Association.	Vermont Merino Sheep Breeders' Association, C. A. Chapman, secretary and treasurer, Middlebury, Vt.
Oxford Down	American Oxford Record	American Oxford Down Record Association, W. A. Shafor, secretary, Hamilton, Ohio.
Shropshire	American Shropshire Sheep Record.	American Shropshire Registry Association, Mortimer Levering, secretary, Lafayette, Ind.
Southdown	American Southdown Record.	American Southdown Breeders' Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Suffolk	Register of the American Suffolk Flock Registry Association.	American Suffolk Flock Registry Association, George W. Franklin, secretary, Des Moines, Iowa.

HOGS.

Name of breed.	Book of record.	By whom published.
Berkshire	American Berkshire Record	American Berkshire Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Cheshire	Cheshire Herdbook	Cheshire Swine Breeders' Association, Ed. S. Hill, secretary, Freeville, N. Y.
Chester White	American Chester White Record.	American Chester White Record Association, Ernest Freigau, secretary, Columbus, Ohio.
Chester, Ohio Improved.	O. I. C. Record	O. I. C. Swine Breeders' Association, C. M. Hiles, secretary, 40 Sherriff street, Cleveland, Ohio.
Duroc Jersey	American Duroc Jersey Record.	American Duroc Jersey Swine Breeders' Association, S. E. Morton, secretary, Camden, Ohio.
Do	National Duroc Jersey Record.	National Duroc Jersey Record Association, Robt. J. Evans, secretary, Elpaso, Ill.
Hampshire (Thin Rind).	American Hampshire Record.	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.
Poland China	American Poland China Record.	American Poland China Record Co., W. M. McFadden, secretary, Union Stock Yards, Chicago, Ill.
Do	Ohio Poland China Record	Ohio Poland China Record Co., A. M. Brown, secretary, Dayton, Ohio.
Do	Southwestern Poland China Record.	Southwestern Poland China Record Association, H. P. Wilson, secretary, Gadsden, Tenn.
Do	Standard Poland China Record.	Standard Poland China Record Association, Geo. F. Woodworth, secretary, Maryville, Mo.
Tamworth	American Tamworth Swine Record.	American Tamworth Swine Record Association, E. N. Ball, secretary, Hamburg, Mich.
Yorkshire	American Yorkshire Record	American Yorkshire Club, Harry G. Krum, secretary and treasurer, Whitebear Lake, Minn.

DOGS.

Fifty-seven recognized breeds.	American Kennel Club Studbook.	American Kennel Club, A. P. Vredenburg, secretary, 55 Liberty street, New York, N. Y.

CATS.

Longhaired (Angora or Persian).	United States Register and Studbook (except appendix).	United States Official Register Association (Incorporated), Mrs. S. Hazen Bond, registrar, 310 First street SE., Washington, D. C.
Shorthaired (Siamese, Manx, Mexican, Abyssinian, Indian, Russian, and Japanese).	do	Do.
Longhaired (Persian or Angora).	Studbook of the American Cat Association.	American Cat Association, Lucy C. Johnstone, secretary-treasurer, 5323 Madison avenue, Chicago, Ill.
Shorthaired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, Native).	do	Do.

STATE LIVE STOCK BREEDERS' ASSOCIATIONS.

Name of organization.	Secretary.	Post-office.
Alabama Live Stock Association	W. L. Thornton	Talladega, Ala.
Arizona Cattle Growers' Association	Harry L. Heffner	Pantano, Ariz.
California Live Stock Breeders' Association	E. W. Major	Berkeley, Cal.
California Swine Breeders' Association	H. L. Bishop	Kingsbury, Cal.
Colorado Cattle and Horse Growers' Association	Fred. P. Johnson	Denver, Colo.
Connecticut Sheep Breeders' Association	Burton C. Patterson	Torrington, Conn.
Southeastern Stock Growers' Association	Irving H. Welch	Jacksonville, Fla.
Southwest Georgia Live Stock Association	H. M. McIntosh [a]	Albany, Ga.
State Live Stock Breeders' Association	C. L. Willoughby	Experiment, Ga.
Hawaiian Live Stock Breeders' Association	Albert F. Judd	Honolulu, Hawaii.
Idaho Wool Growers' Association	J. E. Clinton, jr	Boise, Idaho.
Inland Registered Stock Breeders' Association	H. T. French	Moscow, Idaho.
Wood River Cattlemen's Association	T. M. Osborn	Hailey, Idaho.
Illinois Cattle Breeders' Association	O. H. Swigart	Champaign, Ill.
Illinois Cattle Feeders' Association	Charles F. Mills	Springfield, Ill.
Illinois Horse Breeders' Association	George Williams	Athens, Ill.
Illinois Live Stock Breeders' Association	Fred. H. Rankin	Urbana, Ill.
Illinois Sheep Breeders' Association	Eugene Funk	Bloomington, Ill.
Illinois Swine Breeders' Association	Charles F. Mills	Springfield, Ill.
Indiana Improved Stock Breeders' Association	J. H. Skinner	Lafayette, Ind.
Indiana Swine Breeders' Association	W. Midkiff	Shelbyville, Ind.
Iowa Improved Live Stock Breeders' Association	W. J. Rutherford	Ames, Iowa.
Iowa Swine Breeders' Association	C. C. Carlin	3403 Fifth street, Des Moines, Iowa.
Improved Swine Breeders' Association	H. W. Cheney	Topeka, Kans.
Kansas Improved Stock Breeders' Association	H. A. Heath	Do.
Kentucky Live Stock Breeders' Association	Clarence Sale	23 Board of Trade building, Louisville, Ky.
Louisiana Stockbreeders' Association	W. H. Dalrymple	Baton Rouge, La.
Eastern Horse Breeders' Association	J. E. Osborne	Calais, Me.
Massachusetts Cattle Owners' Association	J. L. Harrington	Lunenburg, Mass.
Minnesota Live Stock Breeders' Association	Andrew Boss	St. Anthony, Minn.
Minnesota Sheep Breeders' Association	C. W. Glotfelter	Waterville, Minn.
Minnesota Swine Breeders' Association	Charles Kenning	R. F. D. No. 2, Bird Island, Minn.
Southern Live Stock Association	J. M. Aldrich	Michigan City, Miss.
Improved Live Stock Breeders' Association	Geo. B. Ellis	Columbia, Mo.
Missouri State Sheep Breeders' Association	L. E. Shattuck	Springfield, Mo.
Central Montana Wool Growers' Association	A. C. Logan	Billings, Mont.
Montana Registered Cattle Breeders' Association	John W. Pace	Helena, Mont.
Montana Stock Growers' Association	W. G. Preuitt	425 Power block, Helena, Mont.
North Montana Roundup Association	Roy M. Clary	Conrad, Mont.
North Montana Wool Growers' Association	C. H. Campbell	Greatfalls, Mont.
Nebraska Improved Live Stock Breeders' Association.	O. E. Mickey	Osceola, Nebr.
Nebraska State Swine Breeders' Association	A. T. Cole	Beatrice, Nebr.
Nebraska Stock Growers' Association	E. M. Searle, jr	State capitol, Lincoln, Nebr.
Black Range Protection Association	E. A. Clemens	Magdalena, N. Mex.
New Mexico Cattle Growers' Association	Will C. Barnes	Las Vegas, N. Mex.
New Mexico Sheep Growers' Association	Harry Lee	Albuquerque, N. Mex.

[a] President.

State Live Stock Breeders' Associations—Continued.

Name of organization.	Secretary.	Post-office.
Northeastern New Mexico Cattle Association	Geo. P. Gaylord	Folsom, N. Mex.
New York State Breeders' Association	Thos. F. Hunt	Ithaca, N. Y.
New York State Sheep Breeders' Association	W. W. Smallwood	Warsaw, N. Y,
North Dakota Live Stock Association	E. S. De Lancey	Valley City, N. Dak.
Ohio Horse Breeders' Association	Samuel Taylor	Grove City, Ohio.
Ohio Live Stock Association	C. S. Plumb	Columbus, Ohio.
Ohio Swine Breeders' Association	C. W. Kurtz	Indianapolis, Ind.
Ohio Wool Growers' and Sheep Breeders' Association.	W. N. Cowden	Quaker City, Ohio.
Oklahoma Improved Stock Breeders' Association.	J. A. Alderson	Pondcreek, Okla.
Oklahoma Live Stock Association	W. E. Bolton	Woodward, Okla.
Oregon Live Stock Breeders' Association	M. D. Wisdom	Portland, Oreg.
Pennsylvania Live Stock Breeders' Association	E. S. Bayard	East End, Pittsburg, Pa.
South Carolina Live Stock Association	B. H. Rawl[a]	Clemson College, S. C.
Missouri River Stockmen's Association	John Hayes	Fort Pierre, S. Dak.
Northwestern Stock Growers' Association	Geo. A. Ross	Bellefourche, S. Dak.
South Dakota Improved Live Stock and Poultry Breeders' Association.	Jas. W. Wilson	Brookings, S. Dak.
Western South Dakota Stock Growers' Association.	F. M. Stewart	Buffalogap, S. Dak.
Tennessee Live Stock Breeders' Association	May Overton[b]	42 Arcade, Nashville, Tenn.
Cattle Raisers' Association of Texas	John T. Lytle	Fort Worth, Tex.
Texas Sheep and Goat Breeders' Association	R. A. Bradford	Taylor, Tex.
Utah Cattle Growers' Association	Wesley K. Walton	Murray, Utah.
Mount Pleasant Wool Growers' Association	Fred. C. Jensen	Mount Pleasant, Utah.
Utah Cattlemen's Association	J. Wesley Walton	Salt Lake City, Utah.
Utah Wool Growers' Association	O. P. Hatch	Do.
Washington Live Stock Association	F. M. Rothrock	Spokane, Wash.
West Virginia Live Stock Association	H. E. Williams	Duo, W. Va.
West Virginia Sheep Breeders and Wool Growers' Association.	James B. Beall	Wellsburg, W. Va.
Wisconsin Live Stock Breeders' Association	Frank W. Harding	Waukesha, Wis.
Wisconsin Sheep Breeders' Association	.....do	Do.
Snake River Live Stock Association	Harry L. Hays	Dixon, Wyo.
Wyoming Stock Growers' Association	Miss Alice R. Smith	Cheyenne, Wyo.
Wyoming Wool Growers' Association	Geo. S. Walker	Do.

[a] Acting secretary. [b] President.

THE MOVEMENT OF LIVE STOCK.

The movement, consumption, and range of prices of our domestic live stock for the year 1904 are shown in the series of tables which follow. It should be stated that the information conveyed by these figures is not, in some instances, as accurate and complete as could be desired. There are, necessarily, many duplications in the receipts, because animals arriving at a stock center may be passed on to one or more additional centers before they are finally disposed of. However, the difference between the receipts and shipments will show, in

a general way, the packing and local consumption. The amount which might be computed for the latter would, without doubt, be considerably below the actual mark, inasmuch as the local butchering in the smaller towns, together with the farm consumption, are excluded entirely, there being no means at our disposal of procuring any data of this kind. On the other hand, it must be remembered that the large quantities of meat which go into our export trade figure in the arrivals at Chicago and other places.

The tables are arranged in the following order:

1. Total receipts and shipments of each class of live stock for the United States.
2. Total receipts and shipments of each class of live stock at the several stock and packing centers.
3. Receipts and shipments at each stock center, by months.
4. Average weight of hogs at five leading centers for a series of years, by months.
5. Range of prices, per hundredweight, of cattle at Chicago and Omaha, by months.
6. Range of prices, per hundredweight, of hogs at Chicago and Omaha, by months.
7. Range of prices, per hundredweight, of sheep at Chicago and Omaha, by months.
8. Range and average prices of horses at Chicago and Omaha, by months.

Receipts and shipments of live stock, 1902–1904.

Animals.	1902.		1903.		1904.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Cattle	11,396,925	4,788,991	12,170,273	5,109,409	12,136,135	5,633,703
Calves	1,289,835	250,751	1,552,535	352,210	1,516,934	399,204
Hogs	30,520,945	7,270,307	31,132,634	7,773,795	38,769,524	10,433,224
Sheep	17,573,466	6,884,230	19,199,680	8,333,438	19,637,182	9,340,147
Horses and mules	616,840	485,949	615,749	494,044	733,197	626,474
Total	61,398,011	19,680,228	64,670,871	22,062,896	73,392,972	26,432,752

Summary of receipts and shipments of live stock at stock centers during the calendar year 1904.

Stock center.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Allegheny, Pa.[a]	372,474	221,016	99,994	23,091	1,659,557	749,220	932,091	494,792	....	....
Austin, Minn	554	....	351	....	109,248	....	374	....	....	....
Baltimore, Md	163,682	103,077	33,683	3,877	822,364	149,895	386,578	219,671	10,329	7,663
Bloomington, Ill	....	....	....	....	89,829	5,484	....	....	....	....
Boston, Mass	215,582	[b] 133,358	88,364	....	1,319,186	....	502,199	[b] 93,393	377	[b] 377
Brightwood, Mass	....	....	....	....	155,234	....	....	....	....	....
Cedar Rapids, Iowa	6,269	([c])	171	([c])	514,597	([c])	1,336	([c])	....	....
Chicago, Ill	3,259,185	1,326,332	267,499	23,416	7,238,746	1,626,022	4,504,630	1,362,270	105,949	98,032
Cincinnati, Ohio	201,485	44,848	56,638	4,664	980,035	332,022	380,174	275,416	20,457	10,839
Cleveland, Ohio	69,396	([c])	42,600	([c])	1,046,908	415,638	279,630	([c])	....	....
Cudahy, Wis	23,481	489	9,099	178	561,080	....	18,113	532	....	....
Davenport, Iowa	2,718	....	748	....	39,493	....	136	....	....	....
Denver, Colo	265,462	215,151	....	....	161,954	6,882	519,190	421,322	13,437	11,955
Des Moines, Iowa	14,281	213	139	....	232,242	987	6,145	6,000	....	....
Detroit, Mich	79,327	31,387	29,297	7,013	388,975	73,315	142,497	47,918	160	159
East Buffalo, N. Y	522,918	430,342	113,095	97,491	5,236,480	4,088,640	2,466,657	2,093,000	54,300	48,488
Eau Claire, Wis	842	386	....	....	41,101	....	1,567	330	460	280
Fort Worth, Tex	642,794	173,427	....	....	280,840	1,429	103,650	48,939	17,893	4,490
Indianapolis, Ind	274,710	106,012	....	....	1,668,771	564,408	89,945	60,680	30,728	24,611
Jersey City, N. J	234,311	203,907	91,073	44,835	644,590	....	1,549,555	991,601	....	....
Kansas City, Kans	1,996,610	965,242	166,861	68,242	2,227,170	144,150	1,004,099	262,245	67,562	66,551
Knoxville, Tenn	13,126	....	....	....	2,217	....	3,365	....	....	....
Los Angeles, Cal	52,364	572	....	....	62,075	450	127,900	1,320	3,550	1,992
Louisville, Ky	117,456	46,928	19,027	2,635	891,846	437,880	314,914	274,575	8,137	7,918
Marshalltown, Iowa	....	....	....	....	128,786	1,799	....	....	....	....
Mason City, Iowa	477	....	10	....	15,996	....	....	....	....	....

[a] The figures for Allegheny do not include arrivals over the Baltimore and Ohio Railway, these having merely stopped for feed and water.
[b] Exports.
[c] No record kept of shipments.

Summary of receipts and shipments of live stock at stock centers during the calendar year 1904—Continued.

Stock center.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Milwaukee, Wis	53,609	36,002	50,452	47,871	542,049	293,933	58,746	44,170	2,752	2,752
Nashville, Tenn	18,725	3,657			96,109	47,075	32,335	9,657	65,445	63,602
National Stock Yards, Ill	1,074,126	307,894			1,954,902	372,596	687,896	100,588	181,341	157,673
Nebraska City, Nebr	226	1,010			282,859		216		15	98
New Brighton, Minn	80,544	80,075			787	727	411,689	492,951	3,300	3,296
New Haven, Conn					157,225					
Newport News, Va	22,102	[a] 21,758					2,756	[a] 2,756		
New York, N. Y	188,289	[a] 114,348	262,216		890,854		458,100	[a] 71,366	29,120	[b] 5,954
Norfolk, Va	7,032	[a] 3,546			5,576	[c] 4,700	2,492		15,975	15,566
Ottumwa, Iowa	10,141		1,806		677,459		3,460			
Philadelphia, Pa	182,337	82,089	69,177	2,830	260,560	11,250	536,736	57,318	12,915	7,808
Portland, Me.[d]	22,726	[a] 22,709					35,536	[a] 35,474		
Portland, Oreg	29,725	18,135			40,285	22,050	115,310	57,635	1,845	1,360
Quincy, Ill	3,258		440		52,341		612			
Richmond, Va	23,835						25,550			
St. Louis, Mo	128,275	32,920	10,541		488,326	52,480	47,345	2,573		
Salt Lake City, Utah	2,008	2,008					45,839	45,839		
San Diego, Cal.[e]	5,620		316		3,474		10,831		329	
Seattle, Wash	41,178	1,213	1,194		85,002		189,019	46,822		
Sioux City, Iowa	326,657	228,860	4,636	1,450	1,113,177	613,592	28,464	20,914	4,185	3,679
South Omaha, Nebr	944,192	260,770			2,299,627	210,787	1,754,365	818,995	46,845	45,723
South St. Joseph, Mo	550,549	143,699	36,712	13,070	1,656,849	94,463	794,379	285,063	28,704	28,084
South St. Paul, Minn	351,965	257,545	38,036	18,541	854,657	70,513	759,503	584,603	6,438	6,203
South San Francisco, Cal	95,895		21,060		162,928		269,808			
Tacoma, Wash.[f]	7,197	189			15,141	37	21,789	951		
Topeka, Kans	6,644	9	1,440		109,350		722	1		
Waterloo, Iowa	630		259		40,442		119			

Wichita, Kans	29,146	21,580			312,423	40,800	8,820	8,467	649	1,321
Worcester, Mass					147,802					
Total	12,736,135	5,633,703	1,516,934	399,204	38,769,524	10,433,224	19,637,182	9,340,147	733,197	626,474

[a] Exports.
[b] 2,306 of these horses were exported.
[c] These hogs shipped to Smithfield, Va., to be fed.
[d] The figures given are for domestic animals. In addition, the following Canadian animals were exported during the year: Cattle, 20,448; sheep, 21,273; horses, 14.
[e] The totals include a small number of animals received at Calexico and Tia Juana.
[f] Totals are for about six months; no record kept prior to June 20, 1904.

Monthly receipts and shipments of live stock at stock centers in 1904.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
ALLEGHENY, PA.[a]	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
January	10,862		2,301		107,366		34,280			
February	25,179	13,078	2,922	376	155,064	80,645	66,186	39,728		
March	25,616	16,012	7,488	916	132,923	76,617	58,898	34,519		
April	24,883	15,081	11,718	1,671	132,050	84,630	62,781	24,487		
May	19,930	7,733	16,133	1,869	120,205	59,872	75,473	22,762		
June	23,393	10,809	12,661	1,315	116,297	54,948	92,439	50,542		
July	37,296	24,328	9,840	3,163	114,632	61,783	120,106	83,479		
August	40,375	22,463	9,111	2,241	103,703	51,695	119,922	84,795		
September	43,375	30,289	10,690	5,673	125,308	66,692	106,635	72,577		
October	46,740	29,962	7,111	2,509	159,030	74,580	79,868	45,501		
November	39,170	26,824	5,230	1,775	187,133	66,493	48,505	11,920		
December	35,655	24,437	4,789	1,643	205,846	71,265	66,928	24,452		
Total	372,474	221,016	99,994	23,091	1,659,557	749,220	932,091	494,792		
AUSTIN, MINN.										
January	4		19		11,880		6			
February	19		17		11,440		12			
March	23		37		9,630		6			

[a] The figures for Allegheny do not include arrivals over the Baltimore and Ohio Railway, these having merely stopped for feed and water.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
AUSTIN, MINN.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
April	30		20		7,144		1			
May	29		70		8,424		23			
June	28		44		6,565		32			
July	76		30		8,095		65			
August	88		36		8,344		94			
September	80		31		4,024		46			
October	30		15		6,238		51			
November	100		28		12,401		37			
December	39		8		15,063		1			
Total	554		351		109,248		374			
BALTIMORE, MD.										
January	13,258	9,106	1,525	105	77,610	14,169	22,622	11,134	2,091	1,955
February	10,830	6,376	1,875	90	71,833	14,370	20,762	10,675	1,111	1,142
March	10,189	7,156	2,838	143	72,967	16,598	16,265	9,454	1,252	905
April	10,677	5,816	2,761	84	72,659	14,509	23,238	8,974	1,029	597
May	9,471	5,164	3,800	305	65,547	11,750	26,678	12,795	545	222
June	11,763	5,928	3,428	260	60,649	9,281	42,912	27,145	320	57
July	14,301	8,677	3,357	738	55,666	7,085	56,137	33,467	270	85
August	13,872	9,553	2,910	642	57,937	7,019	49,577	34,349	326	164
September	17,354	10,278	3,841	657	56,708	12,836	38,703	17,810	662	399
October	20,634	14,377	3,079	584	72,978	17,615	39,083	22,899	787	493
November	16,047	10,303	2,523	138	75,840	12,350	28,979	18,088	818	669
December	15,286	10,343	1,746	131	81,970	12,313	21,622	12,881	1,118	975
Total	163,682	103,077	33,683	3,877	822,364	149,895	386,578	219,671	10,329	7,663
BLOOMINGTON, ILL.										
January					10,752					
February					10,302					

March					4,812					
April					5,291					
May					7,458					
June					9,697	2,109				
July					5,420	1,612				
August					4,829					
September					3,746					
October					5,013					
November					9,486	457				
December					13,023	1,306				
Total					89,829	5,484				
BOSTON, MASS.[a]										
January	19,206	12,647	2,876		123,750		45,244	13,332	46	46
February	15,633	10,682	3,297		113,478		38,189	12,565	34	34
March	18,929	12,067	7,019		96,749		31,995	13,752	8	8
April	16,340	11,561	10,107		109,068		28,113	9,699	16	16
May	16,646	10,881	14,297		100,915		27,059	10,090		
June	17,252	11,867	11,431		113,669		28,290	3,610		
July	17,595	8,852	7,665		96,377		47,962	2,724		
August	17,445	10,547	8,230		100,363		66,152	4,130	79	79
September	17,240	10,680	6,511		99,805		52,799	6,295	46	46
October	19,854	11,625	6,347		87,060		47,621	4,915	79	79
November	20,061	10,687	6,798		128,229		47,646	3,649	69	69
December	19,381	11,262	3,786		149,723		41,129	8,632		
Total	215,582	133,358	88,364		1,319,186		502,199	93,393	377	377
BRIGHTWOOD, MASS.										
January					15,817					
February					14,466					
March					11,758					
April					9,691					
May					9,495					
June					11,284					

[a] The shipments from Boston are all exports.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
BRIGHTWOOD, MASS.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
July					11,399					
August					12,717					
September					12,673					
October					12,552					
November					15,722					
December					17,660					
Total					155,234					
CEDAR RAPIDS, IOWA.[a]										
January	540		14		66,659		74			
February	463		7		64,231		53			
March	375		11		30,539		66			
April	446		5		34,851					
May	547		15		44,965		29			
June	362		11		39,045		171			
July	471		10		27,292		145			
August	1,007		24		41,166		211			
September	530		13		15,745		145			
October	483		25		30,944		171			
November	396		13		48,512		97			
December	649		23		70,648		174			
Total	6,269		171		514,597		1,336			
CHICAGO, ILL.										
January	293,300	111,409	13,042	1,095	869,814	159,542	355,926	63,110	8,629	7,974
February	265,704	107,592	12,847	571	845,894	180,529	431,612	93,769	12,863	10,864
March	261,076	117,442	24,112	885	612,141	236,375	374,680	103,897	16,756	16,152
April	246,299	107,867	35,532	1,158	558,122	188,002	301,301	51,334	12,656	12,270
May	236,647	96,483	39,515	855	580,014	143,597	288,571	45,436	10,479	8,869

June	267,681	96,755	32,010	842	577,138	105,838	332,442	31,043	6,544	6,707
July	154,526	74,155	12,853	2,326	349,558	97,778	216,945	93,983	4,964	4,687
August	272,599	116,419	17,976	4,559	502,465	123,163	420,746	224,019	7,018	6,251
September	277,068	126,341	22,011	3,541	356,264	98,076	466,951	239,701	7,277	6,966
October	362,376	132,335	20,594	2,851	477,217	83,131	574,694	251,401	8,323	7,316
November	338,987	118,823	21,253	2,606	705,440	106,885	422,450	97,473	5,432	5,063
December	282,922	120,711	15,754	2,127	804,679	103,106	318,312	67,104	5,008	4,913
Total	3,259,185	1,326,332	267,499	23,416	7,238,746	1,626,022	4,504,630	1,362,270	105,949	98,032
CINCINNATI, OHIO.										
January	14,943	2,903	3,183	27	96,766	29,183	6,477	1,147	1,678	1,472
February	15,200	2,488	3,746	74	82,563	26,295	5,567	647	1,368	928
March	12,812	1,962	4,514	209	65,578	24,641	5,080	144	2,543	1,101
April	16,007	2,895	6,089	69	70,376	27,746	6,169	310	2,256	1,103
May	17,675	3,844	5,879	402	67,268	24,771	16,561	8,251	1,754	880
June	18,328	3,703	6,176	789	69,744	18,770	94,484	77,256	1,371	312
July	14,864	2,573	4,574	522	54,957	15,605	113,740	99,638	800	357
August	18,501	3,821	5,155	896	65,788	20,467	71,229	60,871	1,994	999
September	17,965	4,821	5,070	867	65,051	25,443	24,969	13,629	1,948	1,277
October	21,617	6,070	4,645	363	99,140	38,053	15,346	5,293	1,717	933
November	16,368	4,115	4,238	303	129,021	44,898	10,931	3,732	1,580	762
December	17,205	5,653	3,389	143	113,783	36,150	9,621	4,498	1,448	715
Total	201,485	44,848	56,638	4,664	980,035	332,022	380,174	275,416	20,457	10,839
CLEVELAND, OHIO.[b]										
January	5,184	....	2,001	....	113,270	52,093	25,379	....	....	....
February	5,397	....	2,057	....	74,749	21,106	20,644	....	....	....
March	4,198	....	4,278	....	50,611	17,108	18,405	....	....	....
April	4,801	....	6,101	....	63,092	17,288	23,215	....	....	....
May	4,895	....	4,924	....	70,588	17,545	20,325	....	....	....
June	9,381	....	5,052	....	92,622	33,438	33,438	....	....	....
July	6,258	....	3,587	....	64,489	26,017	13,611	....	....	....
August	4,698	....	3,249	....	63,885	13,277	13,525	....	....	....
September	5,946	....	3,292	....	69,981	22,538	23,254	....	....	....
October	5,799	....	2,924	....	92,861	40,715	24,110	....	....	....

[a] No record kept of shipments.

[b] No record kept of shipments of cattle, calves, and sheep.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
CLEVELAND, OHIO—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
November	6,502		2,683		136,138	80,752	29,956			
December	6,337		2,452		154,622	73,761	33,768			
Total	69,396		42,600		1,046,908	415,638	279,630			
CUDAHY, WIS.										
January	1,890	23	515		78,854		1,136	57		
February	1,915	41	616	35	48,231		951	23		
March	1,643	35	711	14	25,935		1,524	45		
April	1,659	49	847	27	21,981		1,557	120		
May	1,740	57	1,119		36,522		1,144			
June	1,912	34	819	13	57,122		1,233	74		
July	2,467	38	970		44,434		1,822	93		
August	2,090	49	853		57,304		2,350			
September	2,241	73	775	42	26,649		1,623	32		
October	1,883	35	600	19	30,548		1,829	47		
November	1,959	42	733	28	50,847		1,856	30		
December	2,082	23	541		82,653		1,088	11		
Total	23,481	489	9,099	178	561,080		18,113	532		
DAVENPORT, IOWA.										
January	265		54		5,131					
February	235		55		4,374		8			
March	232		56		3,915					
April	264		57		3,215					
May	265		78		2,791		13			
June	260		73		3,395					
July	231		73		3,035		25			
August	296		68		2,765		46			
September	246		93		2,668		27			

October	151	......	52	......	1,629	......	9	......	......	......
November	141	......	40	......	2,141	......	......	......	......	......
December	132	......	49	......	4,434	......	8	......	......	......
Total	2,718	......	748	......	39,493	......	136	......	......	......
DENVER, COLO.										
January	14,914	10,213	......	......	22,391	571	13,007	6,412	423	345
February	9,981	6,962	......	......	18,155	267	13,855	8,311	323	348
March	7,253	4,769	......	......	18,032	144	8,159	1,778	781	717
April	6,879	4,163	......	......	9,610	100	5,088	268	143	151
May	78,460	21,265	......	......	11,866	54	3,175	100	577	467
June	54,747	51,024	......	......	11,070	140	11,498	5,031	2,093	1,957
July	36,952	35,623	......	......	9,217	387	10,089	4,601	1,680	1,730
August	10,438	6,560	......	......	11,470	1,384	19,005	7,951	1,852	1,481
September	15,288	9,915	......	......	12,399	465	60,507	47,608	2,228	1,540
October	28,328	20,382	......	......	10,565	400	160,779	125,427	1,829	1,803
November	32,002	27,120	......	......	14,570	1,551	165,851	165,389	1,186	1,035
December	20,220	17,155	......	......	12,609	1,419	48,177	48,446	322	381
Total	265,462	215,151	......	......	161,954	6,882	519,190	421,322	13,437	11,955
DES MOINES, IOWA.										
January	726	......	......	......	25,693	......	......	......	......	......
February	762	......	......	......	24,956	......	......	......	......	......
March	673	......	......	......	13,187	......	......	......	......	......
April	811	......	5	......	11,409	285	......	......	......	......
May	973	......	......	......	18,407	......	12	......	......	......
June	1,091	......	18	......	25,132	702	48	......	......	......
July	1,533	......	23	......	17,426	......	47	......	......	......
August	2,017	......	17	......	22,525	......	4	......	......	......
September	1,702	......	11	......	10,808	......	......	......	......	......
October	1,312	60	26	......	8,716	......	9	......	......	......
November	1,477	57	39	......	19,412	......	25	......	......	......
December	1,204	96	......	......	34,571	......	6,000	6,000	......	......
Total	14,281	213	139	......	232,242	987	6,145	6,000	......	......

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
DETROIT, MICH.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
January	5,720	2,081	1,257	231	26,718	5,707	11,883	5,506	24	24
February	5,997	2,431	1,631	397	34,667	5,301	15,270	6,854	20	20
March	3,993	1,321	1,647	294	25,763	6,104	7,185	1,690		
April	4,787	1,733	2,430	619	28,805	5,675	5,833	953	38	38
May	6,053	2,279	3,969	1,100	33,641	6,498	9,763	3,157		
June	7,039	2,721	3,439	652	27,943	4,051	6,486	1,098	24	24
July	6,761	2,933	2,565	293	21,262	4,016	8,694	1,685	51	51
August	8,471	4,039	2,847	432	33,085	5,141	12,304	2,753		
September	7,987	3,777	2,423	489	31,774	6,539	16,391	6,112	1	
October	9,026	3,148	2,859	787	34,488	5,242	17,821	4,592		
November	6,493	2,265	2,126	716	39,757	10,194	13,995	4,651		
December	7,000	2,659	2,104	1,003	51,064	8,847	16,872	8,867	2	2
Total	79,327	31,387	29,297	7,013	388,975	73,315	142,497	47,918	160	159
EAST BUFFALO, N. Y.										
January	41,536	30,184	4,346	3,175	504,160	380,640	268,200	227,200	3,740	2,831
February	39,314	34,276	4,283	2,806	382,560	316,000	215,400	184,000	5,000	4,199
March	33,968	38,578	5,541	4,764	329,280	270,560	185,746	180,000	8,580	7,695
April	37,290	29,414	12,994	12,310	367,040	288,960	201,729	192,000	7,940	7,296
May	38,434	32,516	15,424	14,374	359,040	272,800	194,651	163,800	6,320	6,783
June	43,076	35,046	12,227	10,876	398,880	316,800	105,174	84,600	4,320	4,313
July	57,002	45,100	9,109	7,662	385,920	301,600	136,721	115,000	3,560	3,097
August	49,280	46,464	11,183	9,289	398,080	322,400	214,320	162,200	3,780	3,173
September	47,278	40,634	11,241	9,762	453,280	340,960	218,782	169,800	3,200	2,755
October	49,522	37,950	11,042	9,164	441,440	326,240	230,411	192,600	3,580	2,679
November	42,240	34,210	8,381	7,168	583,520	443,680	255,589	215,600	2,480	2,261
December	43,978	35,970	7,324	6,141	633,280	508,000	239,934	206,200	1,800	1,406
Total	522,918	430,342	113,095	97,491	5,236,480	4,088,640	2,466,657	2,093,000	54,300	48,488

EAU CLAIRE, WIS.										
January	56	45	...	...	6,450	...	65	...	18	20
February	95	35	...	...	2,980	...	35	125	...	...
March	25	...	...	...	1,560	...	60	...	190	...
April	30	20	...	...	2,163	...	45	...	38	19
May	75	35	...	...	2,550	...	75	...	...	18
June	24	23	...	...	2,143	...	83	...	18	...
July	60	...	...	...	1,910	...	225	...	20	...
August	50	20	...	...	1,375	...	250	...	...	58
September	75	45	...	...	1,100	...	150	...	60	19
October	125	75	...	...	3,530	...	265	...	57	18
November	87	65	...	...	7,480	...	150	...	40	20
December	140	23	...	...	7,860	...	164	205	19	108
Total	842	386	...	...	41,101	...	1,567	330	460	280
FORT WORTH, TEX.										
January	36,452	5,338	...	...	25,171	183	2,695	596	1,994	381
February	32,158	3,178	...	...	31,741	174	5,277	1,443	1,087	389
March	31,763	4,215	...	...	36,647	800	3,405	807	586	97
April	52,339	27,711	...	...	32,591	18	11,792	4,206	815	619
May	55,870	24,877	...	...	23,429	103	29,396	17,333	850	410
June	67,094	24,693	...	...	13,148	4	21,437	14,972	548	107
July	31,801	8,554	...	...	7,178	6	3,908	4	714	202
August	46,492	5,993	...	...	8,467	4	4,096	712	944	199
September	59,111	13,953	...	...	20,857	35	4,019	1,134	2,636	439
October	70,600	12,315	...	...	24,848	12	4,745	1,011	3,660	652
November	88,770	26,219	...	...	24,735	12	6,300	4,315	2,492	485
December	70,343	17,381	...	...	32,028	78	6,670	2,406	1,567	510
Total	642,794	173,427	...	...	280,840	1,429	103,650	48,939	17,893	4,490
INDIANAPOLIS, IND.										
January	22,788	7,114	...	...	159,708	54,909	6,495	3,903	3,709	3,180
February	19,088	6,217	...	...	124,338	50,961	4,666	2,964	2,601	2,229
March	16,225	5,789	...	...	61,939	19,636	2,763	838	4,001	3,446
April	17,507	5,555	...	...	85,056	27,365	2,065	1,010	2,752	2,147
May	17,899	4,443	...	...	109,217	23,227	4,910	2,884	2,038	1,756

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
INDIANAPOLIS, IND.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
June	25,480	9,090			172,815	45,569	9,685	6,702	1,690	1,366
July	27,473	13,070			158,876	69,485	10,882	7,880	1,476	1,238
August	24,843	11,084			146,358	55,229	14,826	11,356	2,922	2,046
September	27,705	12,906			95,906	51,123	12,095	8,429	2,619	1,823
October	25,435	10,585			111,616	26,435	7,152	4,117	3,088	2,252
November	25,454	9,930			186,487	56,210	6,897	4,827	2,418	1,955
December	24,813	10,229			256,455	84,259	7,509	5,770	1,414	1,173
Total	274,710	106,012			1,668,771	564,408	89,945	60,680	30,728	24,611
JERSEY CITY, N. J.										
January	20,860	18,380	5,630	4,100	61,319		109,650	62,090		
February	18,690	16,674	7,016	4,856	57,680		103,290	64,270		
March	19,314	17,080	9,981	6,991	56,390		100,204	62,803		
April	17,418	15,279	12,940	5,970	52,319		112,601	63,781		
May	19,316	17,254	11,416	4,598	47,608		129,401	89,741		
June	21,416	18,885	9,018	3,078	43,410		131,250	106,910		
July	20,816	17,796	8,080	2,780	40,880		140,318	79,709		
August	22,319	19,403	7,401	3,200	56,850		151,200	101,182		
September	20,320	17,485	5,031	1,401	57,308		160,210	97,890		
October	18,118	15,002	4,918	1,978	53,704		150,301	91,985		
November	17,406	14,519	4,761	2,422	50,418		132,680	86,210		
December	18,318	16,150	4,881	3,461	66,704		128,450	85,030		
Total	234,311	203,907	91,073	44,835	644,590		1,549,555	991,601		
KANSAS CITY, KANS.										
January	161,810	74,049	7,717	2,399	194,260	4,319	82,432	6,472	11,385	11,366
February	138,797	63,200	3,994	78	200,126	859	88,691	13,347	8,477	8,255
March	140,073	65,477	4,720	2,109	152,119	6,973	96,990	12,478	5,230	5,228
April	118,226	43,459	3,085		187,594	9,335	70,391	7,080	3,328	3,269

May	110,946	45,096	4,037	2,161	218,192	14,082	79,051	16,016	2,830	2,822
June	123,742	43,659	10,599	4,770	199,182	17,302	76,626	18,045	2,809	2,771
July	81,584	41,392	9,780	4,544	118,265	26,947	15,931	3,040	2,614	2,611
August	189,271	106,418	22,268	10,051	200,121	31,730	66,280	23,814	4,292	4,288
September	265,585	150,072	29,183	12,485	125,014	10,247	136,921	57,937	6,210	6,210
October	305,789	169,686	35,244	13,965	160,986	9,076	136,386	62,373	8,037	8,013
November	228,364	111,471	26,480	13,023	262,112	13,280	95,238	34,677	7,027	7,000
December	132,423	51,262	9,754	2,657	209,199	......	59,162	6,966	5,323	4,718
Total	1,996,610	965,242	166,861	68,242	2,227,170	144,150	1,004,099	262,245	67,562	66,551
KNOXVILLE, TENN.										
January	1,124	......	......	......	......	......	119	......	......	......
February	883	......	......	......	191	......	65	......	......	......
March	752	......	......	......	27	......	52	......	......	......
April	573	......	......	......	6	......	115	......	......	......
May	728	......	......	......	165	......	468	......	......	......
June	969	......	......	......	6	......	543	......	......	......
July	980	......	......	......	96	......	401	......	......	......
August	1,541	......	......	......	......	......	678	......	......	......
September	1,137	......	......	......	276	......	427	......	......	......
October	2,074	......	......	......	290	......	249	......	......	......
November	1,913	......	......	......	776	......	202	......	......	......
December	452	......	......	......	384	......	46	......	......	......
Total	13,126	......	......	......	2,217	......	3,365	......	......	......
LOS ANGELES, CAL.										
January	4,717	......	......	......	7,110	......	7,220	120	178	408
February	4,518	26	......	......	4,955	90	5,140	120	234	144
March	4,531	......	......	......	5,005	......	9,540	......	568	144
April	5,687	78	......	......	2,560	90	11,800	120	638	48
May	4,252	156	......	......	4,235	90	8,920	120	289	72
June	2,856	......	......	......	1,785	......	8,100	480	288	......
July	3,323	130	......	......	5,790	90	11,740	360	199	72
August	3,877	......	......	......	4,525	......	13,040	......	90	......
September	4,682	......	......	......	5,030	......	12,480	......	334	192
October	4,878	......	......	......	4,855	......	14,220	......	259	192

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
LOS ANGELES, CAL.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
November	4,500	52	....	....	6,010	90	15,420	....	348	456
December	4,543	130	....	....	10,215	....	10,280	....	127	264
Total	52,364	572	....	....	62,075	450	127,900	1,320	3,550	1,992
LOUISVILLE, KY.										
January	12,018	5,796	1,202	107	72,810	37,750	1,644	623	826	1,040
February	11,410	4,156	1,243	153	66,627	37,937	1,624	256	478	499
March	6,418	2,263	1,520	225	57,780	38,015	2,023	823	480	257
April	7,749	3,228	1,537	150	63,830	41,178	3,208	1,418	812	812
May	7,363	2,627	1,866	323	64,646	30,722	26,554	22,580	182	214
June	8,433	3,890	1,998	270	66,077	23,756	116,795	107,109	477	429
July	6,985	2,367	1,524	326	61,974	18,059	81,918	77,785	729	454
August	9,974	4,131	1,787	312	48,665	18,615	54,317	48,577	1,023	947
September	9,486	3,755	1,770	248	68,912	37,717	16,027	12,677	616	744
October	14,766	5,383	1,734	113	115,315	60,099	5,273	1,699	1,149	1,104
November	10,316	3,861	1,476	152	111,304	61,443	3,135	710	672	746
December	12,538	5,475	1,370	256	88,906	32,589	2,394	318	693	672
Total	117,456	46,928	19,027	2,635	891,846	437,880	314,914	274,575	8,137	7,918
MARSHALLTOWN, IOWA.										
January	....	....	....	....	15,484	....	....	....	....	....
February	....	....	....	....	19,193	....	....	....	....	....
March	....	....	....	....	5,667	....	....	....	....	....
April	....	....	....	....	1,012	....	....	....	....	....
May	....	....	....	....	10,162	....	....	....	....	....
June	....	....	....	....	11,869	....	....	....	....	....
July	....	....	....	....	13,563	....	....	....	....	....
August	....	....	....	....	12,182	616	....	....	....	....
September	....	....	....	....	7,937	736	....	....	....	....

October					6,697	447				
November					10,404					
December					14,616					
Total					128,786	1,799				
MASON CITY, IOWA.										
January	23		3		2,129					
February	26		1		1,085					
March	60		1		1,506					
April	36		1		1,135					
May					1,411					
June					1,334					
July	9				1,285					
August	49				1,355					
September	24		3		798					
October	50		1		41					
November	68				884					
December	82				3,033					
Total	477		10		15,996					
MILWAUKEE, WIS.										
January	4,753	3,113	3,124	3,114	77,701	42,959	4,509	3,939	151	151
February	3,734	2,684	3,121	2,980	46,359	28,111	4,258	3,137	214	214
March	3,335	2,165	4,605	4,321	39,250	19,344	2,450	991	357	357
April	3,245	2,582	5,878	5,609	30,124	17,328	1,412	497	309	309
May	4,294	2,918	7,508	7,318	34,405	22,493	2,815	1,355	274	274
June	4,812	3,181	6,261	5,933	40,810	22,304	4,551	3,387	219	219
July	4,665	2,250	4,879	4,543	32,853	11,116	5,768	3,149	110	110
August	5,026	2,792	4,512	4,242	37,761	12,728	7,444	6,128	201	201
September	5,264	3,544	3,313	3,117	35,630	16,433	7,601	6,818	280	280
October	4,636	3,077	2,090	1,988	40,896	25,878	6,807	5,358	282	282
November	5,285	3,527	2,645	2,400	59,441	38,837	6,193	5,390	198	198
December	4,560	3,169	2,516	2,306	66,819	36,400	4,938	4,022	157	157
Total	53,609	36,002	50,452	47,871	542,049	293,933	58,746	44,170	2,752	2,752

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
NASHVILLE, TENN.	*Number.*	*Number.*	*Number.*	*Number.*	*Number*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
January	1,405	228	....	....	10,767	7,607	340	....	15,206	15,648
February	783	535	....	....	7,394	4,786	76	....	6,491	6,666
March	909	256	....	....	7,677	4,804	244	....	3,896	4,087
April	1,218	221	....	....	7,068	4,294	944	37	1,580	1,969
May	914	160	....	....	3,634	2,115	5,040	2,679	789	739
June	1,427	162	....	....	3,189	433	8,568	5,094	819	553
July	1,024	145	....	....	1,919	350	4,562	1,198	761	590
August	1,648	198	....	....	2,789	464	5,840	245	1,560	1,392
September	1,840	160	....	....	10,570	6,081	3,321	221	4,108	3,590
October	3,447	844	....	....	15,710	9,436	1,974	....	8,492	8,002
November	2,437	167	....	....	10,588	5,307	700	183	12,958	12,077
December	1,673	581	....	....	14,804	1,398	726	....	8,785	8,289
Total	18,725	3,657	....	....	96,109	47,075	32,335	9,657	65,445	63,602
NATIONAL STOCK YARDS, ILL.										
January	78,814	17,055	....	....	190,725	26,574	42,600	1,318	23,882	21,583
February	78,832	18,627	....	....	177,197	24,818	44,806	453	16,852	14,223
March	68,502	19,092	....	....	150,648	42,335	47,609	952	15,070	12,925
April	51,601	13,414	....	....	144,558	39,016	41,956	412	8,117	7,009
May	65,399	13,064	....	....	161,725	29,107	77,182	17,551	7,611	5,964
June	127,750	41,198	....	....	160,358	21,359	112,561	35,920	6,967	5,809
July	64,259	29,242	....	....	86,363	24,989	33,379	9,318	7,679	6,882
August	103,921	36,421	....	....	153,105	48,653	61,642	9,205	14,610	11,990
September	125,333	42,057	....	....	146,074	37,526	63,313	12,505	19,392	17,140
October	124,655	31,744	....	....	176,936	24,581	61,178	6,635	22,818	18,773
November	108,701	29,947	....	....	218,538	31,752	53,448	4,051	25,790	23,360
December	76,359	16,002	....	....	188,675	21,886	48,222	2,268	12,553	12,015
Total	1,074,126	307,894	....	....	1,954,902	372,596	687,896	100,588	181,341	157,673

NEBRASKA CITY, NEBR.										
January		111			24,519					18
February	24	97			32,533		11		4	4
March					18,447					
April		181			27,315					
May		43			28,338					
June		223			31,518					
July	22	98			10,775					
August	24	203			15,748				11	
September	17				17,980					
October	18	22			12,479					
November	37				26,207					56
December	24	32			36,998		205			20
Total	226	1,010			282,859		216		15	98
NEW BRIGHTON, MINN.										
January	88	88					35,556	50,245	74	74
February							15,232	50,795		
March	162	162			90	90	130	34,170		
April							4,547	41,493		
May	138	138			20	20	4,772	15,136		
June	229	229			38	38	13,949	13,949		
July	553	552			98	98	39,121	39,111	870	869
August	10,639	10,439			87	87	44,884	44,884	1,321	1,320
September	15,576	15,576			107	107	48,453	39,848	302	300
October	28,036	26,637			84	84	83,347	71,307	568	568
November	23,880	25,015			160	160	91,137	60,921	91	91
December	1,243	1,239			103	43	30,561	31,092	74	74
Total	80,544	80,075			787	727	411,689	492,951	3,300	3,296
NEW HAVEN, CONN.										
January					12,045					
February					7,936					
March					15,729					
April					13,386					
May					11,086					

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
NEW HAVEN, CONN.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
June					11,479					
July					9,432					
August					11,688					
September					15,060					
October					14,278					
November					17,273					
December					17,833					
Total					157,225					
NEWPORT NEWS, VA.[a]										
January	3,419	3,383					1,496	1,496		
February	850	830					681	681		
March	3,202	3,182					579	579		
April	1,052	1,016								
May	958	905								
June	1,323	1,287								
July	2,656	2,624								
August	2,184	2,151								
September	1,656	1,631								
October	2,389	2,376								
November	1,363	1,332								
December	1,050	1,041								
Total	22,102	21,758					2,756	2,756		
NEW YORK, N. Y.[a]										
January	13,807	9,760	8,367		73,753		52,219	5,481	2,012	440
February	11,515	9,353	7,561		85,564		38,557	7,706	2,858	370
March	12,477	10,363	13,242		58,408		36,543	9,134	3,085	472
April	12,428	10,572	45,912		65,245		48,507	7,312	3,135	365

May	14,787	10,735	38,700		79,473		30,723	7,501	2,762	583
June	14,402	7,324	35,869		62,882		7,358	6,131	2,453	535
July	17,585	8,150	29,569		64,475		16,821	4,537	1,539	356
August	17,009	8,995	18,010		56,152		20,305	4,802	1,799	544
September	18,531	8,955	19,662		64,310		56,147	5,181	2,644	465
October	19,116	11,053	12,811		75,658		51,501	6,534	2,592	589
November	17,534	9,414	11,895		93,784		49,174	2,918	2,582	985
December	19,088	9,674	10,618		111,150		50,303	4,119	1,659	250
Total	188,289	114,348	262,216		890,854		458,160	71,366	29,120	b 5,954
NORFOLK VA. c										
January	841	582			281		14		2,959	2,923
February	198				198		53		2,470	2,215
March	564	296					21		2,216	1,905
April	992	738			10		24		1,749	1,939
May	918	646			34		555		477	608
June	947	640			8		425		439	449
July	1,138	644			2		350		263	227
August	337				11		481		410	422
September	303						414		799	809
October	366				165		74		1,280	1,217
November	270				2,503		69		1,199	1,014
December	158				2,364		12		1,714	1,838
Total	7,032	3,546			5,576	d 4,700	2,492		15,975	15,566
OTTUMWA, IOWA.										
January	929		76		60,380		266			
February	937		82		57,943		241			
March	1,056		118		36,885		208			
April	987		136		36,697		256			
May	780		132		60,288		371			
June	635		174		55,143		361			
July	872		183		51,688		435			
August	829		187		73,121		317			

[a] The shipments of cattle and sheep from Newport News and New York are exports.
[b] 2,306 of these horses were exported.
[c] The shipments of cattle from Norfolk are exports.
[d] These hogs shipped to Smithfield, Va., to be fed.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
OTTUMWA, IOWA—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
September	654	....	216	....	37,696	....	259	....	....	....
October	966	....	155	....	50,716	....	253	....	....	....
November	865	....	181	....	80,398	....	285	....	....	....
December	631	....	166	....	76,504	....	208	....	....	....
Total	10,141	....	1,806	....	677,459	....	3,460	....	....	....
PHILADELPHIA, PA.										
January	15,312	7,989	3,936	1	24,440	1,471	32,445	2,495	1,201	471
February	14,651	4,918	4,998	30	22,847	1,349	37,276	3,824	1,044	823
March	13,847	7,145	5,663	111	18,568	861	33,536	5,220	1,768	1,026
April	13,793	7,917	5,778	102	19,552	617	34,711	5,526	1,611	834
May	17,182	6,275	9,651	749	20,261	573	39,621	4,318	1,501	837
June	15,292	7,177	6,851	375	16,827	165	41,723	4,502	748	540
July	15,609	7,573	6,141	425	13,533	448	49,302	5,987	1,073	507
August	14,638	5,973	7,171	268	20,106	505	76,351	9,854	551	541
September	15,830	7,013	5,949	445	20,612	613	49,714	8,178	896	633
October	17,411	7,301	4,999	138	26,787	532	56,499	2,627	965	619
November	12,876	5,286	3,999	143	27,145	1,621	42,571	2,161	955	540
December	15,896	7,522	4,041	43	29,882	2,545	42,987	2,626	602	437
Total	182,337	82,089	69,177	2,830	260,560	11,250	536,736	57,318	12,915	7,808
PORTLAND, ME.[a] [b]										
January	3,976	3,976	....	....	....	....	5,697	5,691	....	....
February	3,409	3,407	....	....	....	....	2,906	2,900	....	....
March	1,750	1,749	....	....	....	....	3,916	3,909	....	....
April	1,812	1,810	....	....	....	....	2,353	2,343	....	....
May	1,490	1,490	....	....	....	....	3,627	3,622	....	....
June	1,187	1,184	....	....	....	....	....	....	....	....
July	276	275	....	....	....	....	150	149	....	....

August	100	100					1,208	1,208		
September	570	567					2,406	2,402		
October	1,452	1,450					6,379	6,372		
November	1,841	1,841					2,058	2,052		
December	4,863	4,860					4,836	4,826		
Total	22,726	22,709					35,536	35,474		
PORTLAND, OREG.										
January	2,480	1,870			3,330	1,615	7,045	1,995	75	45
February	2,800	2,010			3,100	1,635	6,270	3,860	195	40
March	2,260	1,370			2,680	1,465	7,645	6,275	210	200
April	2,530	2,080			2,880	1,980	4,895	2,095	190	140
May	4,555	3,345			3,120	2,290	11,035	5,250	340	175
June	2,765	1,900			1,560	1,145	11,505	6,930	190	65
July	2,285	1,070			1,675	1,085	11,270	6,570	165	160
August	2,655	1,350			2,930	1,825	12,255	5,250	105	165
September	1,875	535			4,460	2,045	12,150	5,720	140	140
October	1,785	1,175			5,350	1,265	11,550	5,025	125	130
November	1,495	555			5,995	4,265	9,535	2,980	80	75
December	2,240	875			3,205	1,435	10,155	5,685	30	25
Total	29,725	18,135			40,285	22,050	115,310	57,635	1,845	1,360
QUINCY, ILL.										
January	240		10		9,478		42			
February	182		26		5,218		10			
March	249		31		1,884		74			
April	253		38		2,046		25			
May	308		50		2,654		55			
June	282		55		2,964		73			
July	359		39		2,065		20			
August	365		58		3,334		49			
September	385		45		1,772		57			
October	240		27		2,853		93			

[a] The figures given are for domestic animals. In addition, the following Canadian animals were exported during the year: Cattle, 20,448; sheep, 21,273; horses, 14.
[b] The shipments from Portland, Me., are all exports.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
QUINCY, ILL.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
November	175	...	38	...	6,465	...	47	...	...	...
December	220	...	23	...	11,608	...	67	...	...	...
Total	3,258	...	440	...	52,341	...	612	...	...	...
RICHMOND, VA.										
January	1,685	...	...	...	...	...	951	...	...	...
February	1,203	...	...	...	...	...	435	...	...	...
March	2,334	...	...	...	...	...	720	...	...	...
April	2,056	...	...	...	...	...	1,177	...	...	...
May	1,828	...	...	...	...	...	1,450	...	...	...
June	1,950	...	...	...	...	...	1,487	...	...	...
July	2,106	...	...	...	...	...	4,577	...	...	...
August	1,731	...	...	...	...	...	5,813	...	...	...
September	1,906	...	...	...	...	...	3,982	...	...	...
October	3,267	...	...	...	...	...	2,817	...	...	...
November	1,789	...	...	...	...	...	1,362	...	...	...
December	1,980	...	...	...	...	...	779	...	...	...
Total	23,835	...	...	...	...	...	25,550	...	...	...
ST. LOUIS, MO.										
January	3,487	200	147	...	27,074	253	1,611	...	...	...
February	6,064	1,101	246	...	18,533	951	1,581	21	...	...
March	8,526	1,415	650	...	34,686	4,771	1,843	...	...	...
April	8,231	1,802	631	...	48,090	5,190	1,635	...	...	...
May	8,905	2,442	1,102	...	47,753	5,601	3,639	211	...	...
June	11,365	2,167	1,088	...	43,744	5,120	5,056	640	...	...
July	17,916	5,250	1,511	...	45,150	7,677	6,065	877	...	...
August	15,831	4,040	1,319	...	49,060	8,104	8,083	824	...	...
September	15,162	5,500	1,644	...	38,015	5,049	5,844	...	...	...

October	12,827	4,072	1,069		39,242	5,130	4,560			
November	10,795	2,597	706		50,531	3,390	4,758			
December	9,166	2,334	428		46,448	1,244	2,720			
Total	128,275	32,920	10,541		488,326	52,480	47,345	2,573		
SALT LAKE CITY, UTAH.										
January										
February										
March										
April							34,760	34,760		
May							2,977	2,977		
June										
July							1,000	1,000		
August	647	647					1,165	1,165		
September							3,239	3,239		
October							519	519		
November							1,137	1,137		
December	1,361	1,361					1,042	1,042		
Total	2,008	2,008					45,839	45,839		
SAN DIEGO, CAL.[a]										
January	605		8		311		963		49	
February	343		7		284		990		23	
March	591		2		296		816		2	
April	293		33		251		1,506			
May	398		5		276		763		12	
June	336		3		251		665		1	
July	308		4		235		667		159	
August	355		1		253		814		1	
September	415		8		269		867		46	
October	329		173		301		615			
November	773		58		347		864		1	
December	874		14		400		1,301		35	
Total	5,620		316		3,474		10,831		329	

[a] The totals include a small number of animals received at Calexico and Tia Juana.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
SEATTLE, WASH.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
January	3,263		55		6,907		13,618	2,690		
February	3,228		25		5,956		12,150	2,145		
March	3,205				6,396		13,202	2,801		
April	3,426				5,625		14,895	3,656		
May	3,649	331	15		6,178		16,213	4,892		
June	3,326	211	124		5,581		15,955	4,535		
July	3,626	162	180		6,421		17,837	4,375		
August	3,685	135	453		4,149		20,613	5,411		
September	3,533	344	168		6,533		18,960	5,472		
October	3,309	16	115		10,012		16,328	3,284		
November	3,509	8	7		11,929		15,517	4,165		
December	3,419	6	52		9,315		13,731	3,396		
Total	41,178	1,213	1,194		85,002		189,019	46,822		
SIOUX CITY, IOWA.										
January	25,612	14,605	263	22	104,955	54,655	1,398	1,368	139	96
February	20,543	13,120	150	22	106,892	59,161	1,602	1,558	89	68
March	24,880	18,670	211	24	80,144	43,245	1,592	1,035	256	201
April	18,478	12,725	138	18	77,062	40,647	886	126	24	21
May	27,555	21,595	353	32	117,729	68,676	950	345	217	207
June	33,113	28,355	278	35	113,385	66,313	1,241	710	370	356
July	22,016	20,229	190	29	60,398	42,809	522	119	1,023	873
August	23,041	17,179	494	133	73,564	54,523	2,485	1,924	263	228
September	29,304	21,168	489	60	55,733	35,460	2,692	1,556	1,236	1,152
October	41,218	25,399	560	229	59,250	33,131	5,848	4,743	270	229
November	29,018	20,204	947	460	112,231	57,285	6,206	5,093	209	161
December	31,884	15,611	563	386	151,834	57,687	3,042	2,337	89	87
Total	326,657	228,860	4,636	1,450	1,113,177	613,592	28,464	20,914	4,185	3,679

SOUTH OMAHA, NEBR.										
January	76,061	16,385			184,588	468	155,501	25,699	1,066	1,137
February	66,513	11,594			221,897	163	148,854	32,526	2,292	2,158
March	95,109	22,157			198,337	13,268	163,453	48,598	2,245	1,994
April	89,995	21,781			234,236	11,534	120,248	24,616	1,629	1,724
May	68,433	13,641			252,783	5,420	62,474	11,579	1,147	1,188
June	57,218	10,690			264,101	8,874	44,843	9,763	4,593	4,539
July	29,804	6,172			106,405	30,086	46,294	20,701	7,190	6,523
August	61,439	17,424			180,109	91,003	126,438	70,612	8,333	7,787
September	108,286	39,975			135,497	21,802	308,926	208,049	6,684	7,350
October	121,266	46,484			125,059	9,628	308,433	205,011	7,435	7,297
November	101,892	33,156			182,732	9,452	181,021	122,327	3,198	2,909
December	68,176	21,311			213,883	9,089	87,880	39,514	1,033	1,117
Total	944,192	260,770			2,299,627	210,787	1,754,365	818,995	46,845	45,723
SOUTH ST. JOSEPH, MO.										
January	46,964	13,378	1,961	753	148,335	2,041	39,077	5,064	1,928	1,816
February	34,271	12,873	2,111	561	157,481	761	56,144	9,767	2,361	2,333
March	42,808	17,327	2,133	1,120	124,274	1,367	107,535	41,666	2,241	2,356
April	38,761	15,360	1,561	900	147,346	1,962	97,237	37,119	1,656	1,452
May	32,277	9,378	1,439	965	141,778	2,348	66,091	21,056	1,732	1,632
June	36,892	11,159	2,814	892	142,433	7,145	29,325	3,609	1,623	1,600
July	23,735	6,616	3,576	2,581	86,597	35,922	21,242	9,340	2,336	2,288
August	49,681	9,714	3,450	255	126,784	32,798	87,674	39,744	2,834	2,771
September	64,403	11,413	5,613	1,044	104,799	3,318	146,118	72,628	4,081	4,020
October	71,507	14,044	4,455	1,071	109,890	602	63,297	25,189	2,946	2,947
November	66,110	11,385	5,287	2,204	163,077	3,010	53,888	18,414	3,182	3,210
December	43,140	11,052	2,312	724	204,055	3,183	26,751	1,467	1,784	1,659
Total	550,549	143,699	36,712	13,070	1,656,849	94,463	794,379	285,063	28,704	28,084
SOUTH ST. PAUL, MINN.										
January	11,821	6,232	1,758	436	120,397	17,545	114,713	77,586	31	25
February	9,374	4,625	2,169	1,193	61,790	1,097	56,826	29,800	20	17
March	13,439	8,348	2,687	955	78,356	4,004	39,002	32,652	113	109
April	13,306	9,026	3,067	1,613	65,618	3,597	14,863	44,536	77	86
May	15,273	10,922	6,377	4,746	90,085	8,951	6,194	3,375	89	88
June	16,198	11,356	5,132	3,165	81,030	6,924	9,941	3,594	205	207

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
SOUTH ST. PAUL, MINN.—continued.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
July	12,069	7,988	2,245	1,149	40,420	14,435	17,440	9,179	1,304	1,283
August	41,983	32,642	2,643	901	27,608	1,576	56,003	42,382	1,223	1,073
September	47,871	36,033	3,324	1,737	31,786	359	87,946	68,871	1,070	1,107
October	81,090	62,131	3,718	956	63,732	312	174,278	137,253	1,834	1,726
November	64,465	52,832	3,111	1,150	93,356	4,495	138,834	105,868	342	352
December	25,090	15,410	1,805	540	100,479	7,218	43,463	29,507	130	130
Total	351,965	257,545	38,036	18,541	854,657	70,513	759,503	584,603	6,438	6,203
SOUTH SAN FRANCISCO, CAL.										
January	6,109		643		13,395		15,774			
February	7,631		1,332		11,871		18,810			
March	8,975		1,647		11,998		24,212			
April	7,653		1,686		11,036		20,779			
May	8,068		1,949		11,286		21,214			
June	8,682		1,849		10,325		27,208			
July	7,289		2,100		10,812		22,666			
August	8,885		2,392		16,069		26,983			
September	7,912		1,862		16,859		23,071			
October	8,201		1,904		18,283		23,244			
November	8,859		2,067		15,367		26,631			
December	7,621		1,629		15,627		19,216			
Total	95,895		21,060		162,928		269,808			
TACOMA, WASH.[a]										
January										
February										
March										
April										
May										
June	92	45			177		1,155	227		
July	450				226		2,307	386		

August	916	67			728		1,622	6		
September	1,265	51			2,004		3,521	125		
October	1,346	16			3,096	16	5,403	50		
November	1,480	10			3,352	4	4,021	20		
December	1,648				5,558	17	3,760	157		
Total	7,197	189			15,141	37	21,789	951		
TOPEKA, KANS.										
January	551	5	72		8,463		15			
February	536		90		9,526		9			
March	544	1	93		7,174		22			
April	679		98		10,296		11			
May	581		135		9,501		30	1		
June	565		135		9,537		48			
July	570		79		8,408		117			
August	613	1	135		9,573		159			
September	581		157		7,173		41			
October	489	1	205		9,890		108			
November	517		157		10,170		103			
December	418	1	84		9,639		59			
Total	6,644	9	1,440		109,350		722	1		
WATERLOO, IOWA.										
January	34		22		4,085					
February	22		21		4,218		13			
March	23		25		2,917		10			
April	37		23		2,570		1			
May	84		33		3,404		3			
June	73		34		3,285		10			
July	81		19		3,110		15			
August	50		26		2,936		19			
September	68		17		2,187		34			
October	69		18		3,186		1			
November	49		12		4,193		8			
December	40		9		4,351		5			
Total	630		259		40,442		119			

[a] No record kept prior to June 20, 1904.

Monthly receipts and shipments of live stock at stock centers in 1904—Continued.

Stock center and month.	Cattle.		Calves.		Hogs.		Sheep.		Horses and mules.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
WICHITA, KANS.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
January	3,532	2,419			35,898	334	371	1,260	32	125
February	2,444	2,035			34,469	5,903	14		56	229
March	2,616	1,723			35,096	4,991	14	395	32	34
April	2,319	1,978			34,821	8,614	22		32	54
May	1,829	1,470			30,516	8,346	1,264	1,148	190	213
June	1,501	1,396			23,419	4,988	19		57	57
July	1,065	717			9,257	1,083	27		32	37
August	1,848	961			11,694	117	95		60	60
September	2,147	1,775			14,202	264	704		72	80
October	2,347	3,029			17,587	2,258	6			137
November	4,775	2,241			34,880	3,523	5,770	5,664	4	213
December	2,723	1,836			30,584	379	514		82	82
Total	29,146	21,580			312,423	40,800	8,820	8,467	649	1,321
WORCESTER, MASS.										
January					12,919					
February					12,401					
March					11,564					
April					9,839					
May					10,632					
June					12,248					
July					11,265					
August					13,057					
September					10,886					
October					11,342					
November					15,052					
December					16,597					
Total					147,802					

WEIGHTS AND PRICES OF LIVE STOCK.

Average weight of hogs, in pounds, for ten years, by months, at leading cities.

CHICAGO.

Month.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.
January	206	208	203	227	229	231	233	247	236	223
February	205	209	205	224	226	229	227	238	239	220
March	206	215	216	222	223	232	229	230	246	222
April	208	222	210	226	223	231	223	235	243	226
May	214	227	211	227	228	232	225	237	243	227
June	221	231	223	231	229	236	229	240	249	225
July	226	235	230	229	236	237	232	238	249	233
August	239	248	217	238	246	244	243	249	253	237
September	244	257	219	248	247	250	246	252	257	242
October	230	241	220	236	234	240	236	244	242	230
November	232	228	220	218	240	250	235	252	245	241
December	227	226	217	202	238	243	239	245	254	243
Average for year	219	226	216	226	233	237	234	242	246	230

KANSAS CITY.

Month.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.
January	222	224	172	213	230	216	218	224	238	216
February	222	220	176	210	218	207	212	225	231	213
March	216	218	188	207	210	208	211	216	232	213
April	210	223	194	207	207	209	209	216	226	213
May	211	215	196	210	213	213	209	217	222	211
June	208	211	198	205	213	209	210	220	221	212
July	206	213	205	187	206	211	217	219	214	213
August	210	216	209	187	219	211	219	217	216	209
September	206	232	208	185	214	211	218	218	226	212
October	195	223	217	199	213	215	215	210	229	220
November	192	211	223	179	216	230	211	221	238	227
December	194	220	224	173	218	222	208	217	232	235
Average for year	207	218	200	197	215	213	213	218	227	216

SIOUX CITY.

Month.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.
January	243	217	226	243	254	283	273	281	264	192
February	222	219	222	239	260	257	252	254	258	190
March	230	217	229	238	243	260	254	249	261	200
April	232	235	234	240	244	263	258	264	261	210
May	234	237	238	241	244	263	255	267	271	219
June	236	243	240	245	244	264	262	269	274	226
July	239	248	242	243	242	260	266	270	270	234
August	253	261	253	251	257	260	269	271	267	236
September	260	274	261	262	267	275	286	274	281	237
October	257	278	260	268	274	291	292	281	289	233
November	270	274	253	268	280	296	295	288	285	250
December	269	265	233	231	266	280	299	280	289	266
Average for year	245	247	241	249	258	272	271	278	274	224

Average weight of hogs, in pounds, for ten years, by months, at leading cities—Continued.

OMAHA.

Month.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.
January	250	242	209	234	257	262	287	275	275	194
February	231	235	211	231	237	245	263	269	268	199
March	235	236	220	232	243	247	260	269	261	211
April	236	247	228	232	236	247	260	269	262	217
May	232	248	230	234	237	251	257	271	268	217
June	233	253	232	242	239	250	260	272	273	222
July	232	254	233	231	234	248	263	269	272	226
August	244	265	242	236	239	246	259	270	272	219
September	252	273	253	246	249	256	265	274	282	238
October	251	278	259	250	245	259	274	286	288	246
November	267	268	262	235	253	270	279	290	289	261
December	265	265	256	212	252	268	274	299	291	269
Average for year	244	255	236	235	243	254	266	276	275	227

DENVER.

Month.	1904.	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.
January	254	223	214	211	229	238	257	240	......	......
February	247	232	213	210	218	235	235	249	......	......
March	242	238	220	181	204	235	223	220	......	......
April	286	237	209	201	214	232	238	235	......	......
May	240	240	223	240	216	247	231	241	......	......
June	235	255	232	213	211	225	245	227	......	......
July	244	249	235	195	212	214	236	292	......	......
August	251	256	233	212	221	229	247	307	......	......
September	259	261	238	218	234	239	258	252	......	......
October	240	279	232	235	227	236	253	268	......	......
November	250	205	228	227	226	247	246	226	......	......
December	269	262	240	218	225	243	249	250	......	......
Average for year	251	245	226	213	220	235	243	250	......	......

Range of prices, per hundredweight, of cattle at Chicago and Omaha in 1904, by months, and annual range at Chicago since 1892.

CHICAGO.

Month.	Native steers (1,500-1,800 pounds).	Native steers (1,200-1,500 pounds).	Poor to best cows and heifers.	Native stockers and feeders.	Texas and western steers.
January	$4.55- $5.90	$3.65- $5.85	$2.50-$5.10	$2.00-$4.25	....
February	4.35- 6.00	3.50- 6.00	2.85- 5.00	2.00- 4.35	$3.10-$4.65
March	4.50- 5.80	3.65- 6.00	3.25- 4.80	2.00- 4.60	3.20- 5.00
April	4.45- 5.80	3.80- 5.70	3.25- 5.00	2.10- 4.50	4.25- 4.80
May	4.60- 5.90	3.90- 5.90	3.40- 5.35	2.10- 5.00	3.65- 5.10
June	5.60- 6.70	4.50- 6.65	3.40- 5.75	2.25- 5.05	3.00- 5.95
July	5.40- 6.50	4.40- 6.65	3.50- 5.75	2.10- 4.25	2.90- 5.35
August	4.75- 6.40	3.80- 6.40	2.50- 5.30	1.90- 4.65	2.40- 4.85
September	4.90- 6.50	3.65- 6.55	2.30- 5.00	1.75- 4.10	2.50- 5.10
October	5.10- 7.00	3.50- 7.00	2.25- 5.60	1.50- 4.25	2.40- 5.65
November	4.70- 7.30	3.50- 7.25	2.30- 5.50	1.50- 4.50	2.25- 5.40
December	4.40-*a*10.50	3.35-*b*12.25	2.00- 7.50	1.50- 4.75	2.40- 5.00
Annual range:					
1904	4.35-*a*10.50	3.35-*b*12.25	2.00- 7.50	1.50- 5.50	2.40- 5.65
1903	4.10- 7.55	3.35- *c*8.35	2.50- 5.50	1.50- 5.20	2.55- 5.10
1902	4.25-*d*14.50	3.60- 9.00	3.35- 8.25	1.90- 6.00	2.55- 7.65
1901	4.75- 9.30	3.60- 12.00	2.00- 8.00	1.65- 5.15	2.75- 5.75
1900	4.70-*e*15.50	3.90- 11.00	1.75- 6.00	2.10- 5.25	3.00- 5.90
1899	4.60- 8.50	4.00- 8.25	2.00- 6.85	2.50- 5.40	3.10- 6.75
1898	4.10- 6.25	3.80- 6.15	2.00- 5.40	2.50- 5.40	3.15- 5.40
1897	4.00- 6.00	3.35- 6.00	1.75- 5.40	2.40- 4.75	2.75- 4.90
1896	3.40- 6.50	2.90- 6.25	1.75- 4.40	2.20- 4.10	2.10- 5.50
1895	3.60- 6.60	2.90- 6.40	2.00- 5.75	2.25- 5.15	2.25- 5.75
1894	3.00- 6.60	2.90- 6.00	1.75- 4.40	2.00- 4.15	2.50- 5.00
1893	4.00- 6.75	2.90- 6.50	2.00- 5.00	2.25- 4.90	3.50- 6.00
1892	3.75- 7.00	2.86- 6.35	1.85- 4.00	2.00- 4.10	1.50- 5.25

a $10.50 represents the price paid for the grand championship load at the International of 1904.
b $12.25 represents the price paid for the champion load of Angus yearlings at the International of 1904.
c The top price, $8.35, was attained by one load of yearling Hereford steers, averaging 1,099 pounds.
d One load of Aberdeen-Angus steers, averaging 1,510 pounds, sold at $14.50.
e Fifteen Aberdeen-Angus steers, averaging 1,492 pounds, sold at $15.50.

OMAHA.

Month.	Native beeves.	Native cows.	Stockers and feeders.	Western steers.	Western cows.
January	$3.20-$5.10	$2.00-$4.25	$2.25-$4.00	....	....
February	3.00- 5.50	2.00- 4.10	2.15- 4.10	....	....
March	2.75- 5.20	1.75- 4.00	2.40- 4.55	....	....
April	3.00- 5.10	2.30- 4.50	2.60- 4.60	....	....
May	3.00- 5.55	1.80- 4.85	2.50- 4.40	....	....
June	3.50- 6.25	1.65- 5.15	2.35- 5.00	$3.55-$4.75	$2.50-$3.85
July	3.40- 6.00	2.00- 4.90	2.60- 4.55	3.15- 4.35	2.40- 3.80
August	3.25- 5.85	2.10- 4.50	2.65- 3.75	2.90- 5.10	1.50- 3.30
September	4.00- 6.00	2.00- 3.30	2.00- 3.85	2.50- 4.65	1.75- 3.20
October	4.25- 6.35	2.10- 2.85	2.25- 3.95	2.65- 4.50	1.40- 3.35
November	3.10- 6.15	1.75- 3.35	2.50- 4.15	3.00- 4.85	1.90- 3.40
December	3.10- 6.15	1.75- 4.10	2.50- 4.00	2.50- 4.60	1.65- 3.10

Range of prices, per hundredweight, of hogs at Chicago and Omaha in 1904, by months, and annual range at Chicago since 1892.

CHICAGO.

Month.	Heavy packing (250-500 pounds).	Mixed packing (200-250 pounds).	Light bacon (150-200 pounds).
January	$4.40-$5.20	$4.35-$5.20	$4.20-$5.00
February	4.55- 5.80	4.50- 5.75	4.30- 5.60
March	4.80- 5.82½	4.85- 5.80	4.45- 5.60
April	4.25- 5.50	4.40- 5.47½	4.30- 5.40
May	4.10- 4.95	4.15- 4.95	4.15- 4.90
June	4.30- 5.45	4.35- 5.45	4.35- 5.40
July	4.70- 5.85	4.90- 5.80	5.00- 5.90
August	4.50- 5.72½	4.80- 5.75	4.95- 5.80
September	4.50- 6.30	4.95- 6.37½	5.20- 6.30
October	4.50- 6.30	4.70- 6.30	4.70- 6.20
November	4.30- 5.25	4.35- 5.25	4.15- 5.15
December	4.15- 5.20	4.20- 4.87½	4.00- 4.80
Annual range:			
1904	4.10- 6.30	4.15- 6.37½	4.00- 6.30
1903	3.85- 7.87½	3.90- 7.80	3.90- 7.70
1902	5.70- 8.25	5.65- 8.20	5.40- 7.95
1901	4.80- 7.37½	4.85- 7.30	4.75- 7.20
1900	4.15- 5.85	4.15- 5.82½	4.10- 5.75
1899	3.35- 4.95	3.40- 5.00	3.30- 5.00
1898	3.10- 4.80	3.10- 4.70	3.10- 4.65
1897	3.00- 4.45	3.20- 4.50	3.20- 4.65
1896	2.40- 4.45	2.75- 4.45	2.80- 4.45
1895	3.20- 5.45	3.25- 5.55	3.25- 5.70
1894	3.90- 6.75	3.90- 6.55	3.50- 6.45
1893	3.80- 8.75	4.25- 8.65	4.40- 8.59
1892	3.70- 7.90	3.60- 6.85	3.60- 6.85

OMAHA.

Month.	Heavy packing (275-500 pounds).	Mixed packing (230-270 pounds).	Light bacon (150-225 pounds).
January	$4.55 -$5.00	$4.50 -$4.87½	$4.20 -$4.95
February	4.75 - 5.60	4.70 - 5.50	4.50 - 5.40
March	4.95 - 5.40	4.90 - 5.30	4.60 - 5.22½
April	4.62½- 5.15	4.60 - 5.15	4.50 - 5.17½
May	4.37½- 4.77½	4.32½- 4.72½	4.20 - 4.67½
June	4.52½- 5.27½	4.47½- 5.20	4.27½- 5.15
July	4.90 - 5.35	4.85 - 5.37½	4.50 - 5.27½
August	4.65 - 5.25	4.75 - 5.30	4.82½- 5.40
September	5.00 - 5.85	5.10 - 5.90	5.15 - 6.05
October	4.92½- 5.75	4.95 - 5.82½	4.92½- 5.85
November	4.45 - 5.00	4.47½- 4.97½	4.45 - 5.00
December	4.25 - 4.65	4.27½- 4.57½	4.30 - 4.65

Range of prices, per hundredweight, of sheep at Chicago and Omaha in 1904, by months, and annual range at Chicago since 1892.

CHICAGO.

Month.	Native sheep (60–140 pounds).	Native yearlings and lambs.	Western sheep (70–140 pounds).	Western and Mexican lambs.
January	$2.00–$4.75	$3.00–$6.35	$2.25–$4.75	$3.00–$6.25
February	2.00– 4.75	2.75– 6.15	2.40– 4.75	4.00– 6.25
March	2.00– 5.50	2.75– 5.90	2.75– 5.45	4.25– 6.15
April	2.50– 6.00	2.50–[a]6.25	3.50– 5.80	4.00–[a]7.05
May	2.00– 6.00	3.00–[a]6.75	2.75– 5.80	3.40–[a]7.10
June	1.75– 5.50	3.25– 6.75	2.25– 5.50	3.50– 7.50
July	1.50– 5.50	3.50– 7.75	2.00– 5.65	4.65– 7.40
August	2.00– 4.25	3.00– 7.00	2.00– 4.25	4.00– 6.85
September	1.75– 4.50	3.00– 6.35	2.00– 4.35	4.00– 6.00
October	1.50– 4.75	3.00– 6.25	2.00– 4.75	3.25– 5.90
November	1.75– 5.00	3.50– 6.20	2.00– 4.85	3.60– 6.00
December	2.50– 5.65	4.25– 7.40	3.00– 5.60	4.50– 7.35
Annual range:				
1904	1.50– 6.00	2.50– 7.75	2.00– 5.80	3.00– 7.50
1903	1.25– 7.00	2.50– 8.00	2.00– 7.00	2.50– 7.90
1902	1.25– 6.50	2.00– 7.25	1.25– 6.30	2.50– 7.60
1901	1.40– 5.25	2.00– 6.25	1.50– 5.25	2.75– 5.90
1900	2.00– 6.50	3.00– 7.60	3.00– 6.50	4.00– 7.60
1899	2.25– 5.65	3.50– 7.45	2.50– 5.55	4.00– 7.00
1898	2.00– 5.25	3.50– 7.10	3.00– 5.25	3.75– 6.75
1897	1.25– 5.25	3.00– 6.40	2.15– 5.35	3.50– 7.25
1896	1.00– 4.60	2.75– 6.50	2.15– 4.30	3.50– 6.25
1895	1.25– 5.50	2.25– 6.35	2.50– 5.35	3.00– 6.00
1894	1.00– 5.40	2.00– 6.00	2.00– 5.40	2.50– 5.80
1893	1.50– 6.25	2.25– 7.55	2.50– 6.45	2.25– 6.75
1892	2.25– 6.90	3.00– 8.25	3.00– 6.75	3.50– 7.25

[a] Spring lambs sold during 1904 as high as $20, with many at $7 to $10.

OMAHA.

Month.	Native sheep.	Native lambs.	Western sheep.	Western lambs.
January	$2.25–$5.10	$4.75–$6.00	....	....
February	2.60– 5.25	5.00– 6.00	....	....
March	2.50– 5.25	4.75– 5.85	....	....
April	3.25– 5.65	4.25– 6.65	....	....
May	4.00– 5.90	5.00–[a]6.75	....	....
June	4.00– 5.25	4.50– 6.37½	$3.70–$4.85	....
July	3.75– 5.00	4.75– 5.25	3.15– 4.85	$4.50–$7.00
August	3.40– 4.35	4.50– 5.25	2.35– 4.05	4.00– 5.50
September	....	5.00– 5.50	3.15– 3.90	4.30– 5.35
October	....	4.00– 5.25	3.25– 4.25	4.25– 5.35
November	3.75– 4.50	4.75– 5.60	2.50– 4.70	4.60– 5.75
December	4.00– 5.50	5.00– 6.35	3.00– 4.75	4.50– 5.45

[a] Spring lambs (April) $15.

Range and average price of horses at Chicago and Omaha in 1904, by months, and annual average at Chicago since 1900.

CHICAGO.

Month.	Draft horses.	Carriage teams.	Drivers.	General use.	Bussers and trammers.	Saddlers.	Southern chunks.
January	$170	$430	$150	$125	$135	$160	$67½
February	175	495	155	135	145	170	72½
March	185	500	160	135	150	180	72½
April	185	500	160	135	150	180	72½
May	180	500	160	135	150	180	67½
June	180	490	155	130	145	170	65
July	175	475	150	125	140	165	62½
August	175	465	145	120	140	160	60
September	170	460	140	120	135	155	60
October	170	460	140	120	135	155	60
November	175	460	140	120	135	155	55
December	180	455	135	120	135	155	50
Annual average:							
1904	177	475	150	140	140	160	64
1903	171	455	150	122	140	156	62
1902	166	450	145	117	135	151	57
1901	157	400	137	102	121	147	52
1900	155	410	140	105	115	150	50

OMAHA.

Month.	Draft horses.	Carriage teams.	Drivers.	General use.	Chunks.	Western.	Southern.
January	$120–$175	$300–$400	$75–$150	$65–$90	$85–$110	$15–$50	$45–$90
February	120– 175	300– 400	75– 150	70– 90	90– 115	10– 50	40– 80
March	120– 175	300– 400	75– 150	75– 95	90– 115	10– 50	35– 70
April	125– 200	300– 400	90– 175	75–100	100– 135	10– 50	30– 65
May	140– 275	300– 750	125– 300	90–125	115– 165	15– 35	30– 65
June	135– 250	300– 700	125– 300	75–110	90– 150	15– 40	30– 60
July	125– 200	300– 400	120– 175	65–100	85– 130	15– 65	30– 60
August	120– 175	300– 400	100– 175	50– 90	75– 120	15– 90	30– 60
September	120– 175	300– 400	100– 175	60–100	75– 120	15–110	30– 60
October	125– 200	300– 450	125– 200	65–100	80– 115	15–100	40– 75
November	130– 235	300– 450	125– 200	70–100	85– 125	10– 35	40– 90
December	130– 225	300– 400	125– 200	70–100	85– 125	12½– 60	40– 75

RULES AND REGULATIONS OF THE BUREAU OF ANIMAL INDUSTRY ISSUED IN 1904.

(AMENDMENT NO. 4 TO B. A. I. ORDER NO. 33.)

Regulations for the Inspection of Live Stock and their Products.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 27, 1904.

It is hereby ordered, That the first paragraph of section 23 of the regulations for the inspection of live stock and their products, issued under date of March 15, 1899 (B. A. I. Order No. 33), be, and it is hereby, amended to read as follows:

Separate cellars must be provided in which microscopically inspected meats must be cured, stored, packed, and stamped, and no other meats shall be cured, stored, packed, or stamped therein. These cellars must be so arranged that they can be securely locked and the keys to the same shall remain in the possession of a trusted employee of the Department of Agriculture, who will lock and unlock the cellars as the business requires; he must also be present during the time that the cellars remain unlocked, and keep an accurate account of all meats going into and from such cellars.

The above amendment will be in effect on and after April 1, 1904, and packers will make any necessary alterations in their equipment before that date.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 2 TO B. A. I. ORDER NO. 109.)

Regulations for the Inspection and Quarantine of Horses, Neat Cattle, Sheep, and other Ruminants, and Swine Imported into the United States—Importation of Cattle from the Netherlands.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 24, 1904.

It is hereby ordered, That section 5 of the regulations for the inspection and quarantine of horses, neat cattle, sheep, and other ruminants, and swine imported into the United States, issued under date of April 10, 1903 (B. A. I. Order No. 109), be, and it is hereby, amended by the addition after the words "Great Britain," in the second line, of the words "or the Netherlands (Holland)," and by striking out the words "stationed in that country," in the fifth line, and by inserting in place thereof the words "before being exported."

Cattle from the Netherlands must be shipped direct from a port in that country to the United States or may be transshipped at an English port. They will not be eligible for entry into the United States if shipped through or landed at any port in continental Europe outside of the Netherlands. Such cattle will be subject to a quarantine of ninety days, counting from the date of shipment.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 3 TO B. A. I. ORDER NO. 109.)

Regulations for the Inspection and Quarantine of Horses, Neat Cattle, Sheep, and other Ruminants, and Swine Imported into the United States.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 26, 1904.

It is hereby ordered, That rule 1 of the regulations for the inspection and quarantine of animals imported into the United States issued under date of April 10, 1903 (B. A. I.

Order No. 109), be, and is hereby, amended by the addition of Lowelltown, Me. (port of Bangor, Me.), as an animal quarantine station during the months of September, October, and November, 1904, for the inspection and quarantine of animals imported into the United States. This order to terminate November 30, 1904.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 121.)

Regulations to Prevent the Spread of Splenetic Fever of Cattle.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 14, 1904.

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

In furtherance of the regulations for the suppression and extirpation of contagious and infectious diseases among domestic animals in the United States, dated March 10, 1903 (B. A. I. Order No. 106), notice is hereby given that a contagious and infectious disease, known as splenetic, southern, or Texas fever, exists among cattle in the district described below:

1. All that country lying south, or below, a line beginning at the northwest corner of the State of California; thence east, south, and southeasterly along the boundary line of said State of California to the southeastern corner of said State; thence southerly along the western boundary line of Arizona to the southwest corner of Arizona; thence along the southern boundary lines of Arizona and New Mexico to the southeastern corner of New Mexico; thence northerly along the eastern boundary of New Mexico to the southern line of the State of Colorado; thence along the southern boundary lines of Colorado and Kansas to the southeastern corner of Kansas; thence southerly along the western boundary line of Missouri to the southwestern corner of Missouri; thence easterly along the southern boundary line of Missouri to the western boundary line of Dunklin County; thence southerly along the said western boundary to the southwestern corner of Dunklin County; thence easterly along the southern boundary line of Missouri to the Mississippi River; thence northerly along the Mississippi River to the northern boundary line of Tennessee at the northwest corner of Lake County; thence easterly along said boundary line to the northeast corner of Henry County; thence in a northerly direction along the boundary of Tennessee to the northwest corner of Stewart County; thence in an easterly direction along the northern boundary of Tennessee to the southwestern corner of Virginia; thence northeasterly along the western boundary line of Virginia to the northernmost point of Virginia; thence southerly along the eastern boundary line of Virginia to the northeast corner of Virginia, where it joins the southeastern corner of Maryland, at the Atlantic Ocean.

2. Whenever any State or Territory located above or below said quarantine line, as above designated, shall duly establish a different quarantine line, and obtain the necessary legislation to enforce said last-mentioned line strictly and completely within the boundaries of said State or Territory and said last-above-mentioned line and the measures taken to enforce it are satisfactory to the Secretary of Agriculture, he may, by a special order, temporarily adopt said State or Territorial line.

Said adoption will apply only to that portion of said line specified, and may cease at any time the Secretary may deem it best for the interests involved, and in no instance shall said modification exist longer than the period specified in said special order; and at the expiration of such time said quarantine line shall revert without further order to the line first above described.

Whenever any State or Territory shall establish a quarantine line for above purposes, differently located from the first above-described line, and shall obtain by legislation the necessary laws to enforce the same completely and strictly, and shall desire a modification of the Federal quarantine line to agree with such State or Territorial line, the proper authorities of such State or Territory shall forward to the Secretary of Agriculture a true map or description of such line and a copy of the laws for enforcement of same, duly authenticated and certified.

3. From the 1st day of February, 1904, no cattle are to be transported from said area south or below said Federal quarantine line above described to any portion of the United States above—north, east, or west of—the above-described line, except as hereinafter provided.

4. Cattle from said area may be transported by rail or boat for immediate slaughter, and when so transported the following regulations must be observed:

(*a*) When any cattle in course of transportation from said area are unloaded above—north, east, or west of—said line to be fed or watered or for other purposes, said cattle shall be placed in pens or yards set apart for infected cattle, and no other cattle shall be admitted thereto.

(*b*) On unloading said cattle at their points of destination, chutes, alleyways, and pens, sufficiently isolated, shall be set apart to receive them, and no other cattle shall be admitted to said chutes, pens, and alleyways; and the regulations relating to the movement of cattle from said area, prescribed by the cattle sanitary officers of the State where unloaded, shall be carefully observed. The cars or boats that have carried said stock shall be cleansed and disinfected as soon as possible after unloading and before they are again used to transport, store, or shelter animals or merchandise.

(*c*) Where southern cattle and cattle originating outside of the quarantined district are yarded in adjacent pens, there shall be left a space between them not less than ten feet wide, and there shall be on each side of this space, which shall not be used for cattle, a tight board fence not less than five feet high.

(*d*) All cars carrying cattle from the quarantined area shall bear on both sides printed placards, the letters of which shall be plain and not less than 1½ inches in height to be affixed by the railroad company hauling the same, stating that said cars contain southern cattle; and each of the waybills, conductor's manifests, and bills of lading of said shipments by cars or boats shall have a note plainly written or stamped upon its face with a similar statement. The placards shall state the name of the place from which the shipment was made, with the date, and the name of the place of destination; said date must correspond with the date of the waybill and other papers. Whenever any cattle have come from said area and shall be reshipped from any point at which they have been unloaded to other points of destination, the cars carrying said animals shall bear on both sides similar placards with like statements, and the waybills, conductor's manifests, or bills of lading be so stamped. At whatever point these cattle are unloaded they must be placed in separate pens, to which no other cattle shall be admitted.

(*e*) No boat having on board cattle from said district shall receive on board cattle from outside of said district. Cattle from said district shall not be received on board when destined to points outside of said district where proper facilities have not been provided for transferring the said cattle from the landing to the stock yards and slaughterhouses without passing over public highways, unless permission for such passing is first obtained from the local authorities.

(*f*) The cars and boats used to transport such animals, the chutes, alleyways, and pens used during transportation and at points of destination shall be disinfected in the following manner:

(1) Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or saturating it with a 5 per cent solution of 100 per cent carbolic acid; or, if not disinfected, it may be stored where no cattle can come in contact with it during the period from February 1 to November 1 of each year.

(2) Wash the cars and the feeding and watering troughs with water until clean.

(3) Saturate the entire interior surface of the cars and the fencing, troughs, chutes, and floors of the pens with a mixture made of 1½ pounds of lime and one-quarter pound of 100 per cent straw-colored carbolic acid to each gallon of water or a solution made by dissolving 4 ounces of chloride of lime to each gallon of water may be used; or disinfect the cars with a jet of steam under a pressure of not less than 50 pounds to the square inch.

(*g*) If the facilities for cleaning and disinfecting cars, as above described, are not provided at the point of destination, the railroad company shall seal and bill the infected cars to a point to be agreed upon between their agent and a representative of the Bureau of Animal Industry, and shall there clean and disinfect them.

(*h*) Cars which have carried cattle within the quarantined district shall be cleaned and disinfected before being taken out of said district, except when loaded with cattle in course of transportation in accordance with these regulations.

5. Notice is hereby given that cattle infested with the *Boophilus annulatus*, or southern cattle tick, disseminate the contagion of splenetic, southern, or Texas fever; therefore cattle originating outside of the district described by this order or amendments thereof, and which are infested with the *Boophilus annulatus* ticks, shall be considered as infectious cattle and shall be subject to the rules and regulations governing the movement of southern cattle.

6. Stock-yard companies receiving cattle infested with said ticks shall place such cattle in the pens set aside for the use of southern cattle; and transportation com-

panies are required to clean and disinfect all cars and boats which have contained the same, according to the requirements of this Department.

7. Cattle in said district may be shipped after having been properly dipped in Beaumont crude petroleum, under the supervision of an inspector of the Bureau of Animal Industry, without further restriction, excepting such as may be enforced by local authorities at point of destination, provided that application be first made to this Department, and permission granted to establish dipping stations, and that after being dipped the cattle are examined and certified by an inspector of the Bureau of Animal Industry; and further provided that the cattle when dipped be shipped in clean cars and not driven through the infected district or unloaded therein, except at such point as may be duly designated in regulations of this Department.

8. Inspectors are instructed to see that disinfection is properly done, and to report instances of improper disinfection and other violations of this order.

9. Violation of these regulations is punishable by a fine of not less than $100 nor more than $1,000, or by imprisonment not more than one year, or by both such fine and imprisonment.

10. These regulations supersede B. A. I. Order No. 107, dated March 13, 1903, and amendments thereto.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 1 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of California (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of California has agreed to establish and cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Pacific coast where the northern boundary line of San Luis Obispo County connects with the Pacific Ocean; thence easterly along the northern boundary line of San Luis Obispo County to its junction with the western boundary of Kings County; thence northwesterly along the western boundary of Kings and Fresno counties to the western corner of Fresno County; thence northerly, easterly, and southerly along the western, northern, and eastern boundary line of Merced County to the southeast corner thereof; thence northeasterly along the northern boundary of Madera County to the northeast corner thereof; thence southerly and easterly along the eastern boundary lines of Madera, Fresno, and Tulare counties to the southeast corner of Tulare County; thence easterly along the southern boundary line of Inyo County to its intersection with the western boundary line of the State of California.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of California to enforce said quarantine line, therefore the above quarantine line is adopted for the State of California by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

It is further ordered, That, during the continuance of the above line no cattle originating in the quarantined area as described in B. A. I. Order No. 121, as modified, shall be moved, or allowed to move into the counties of Kern, Tulare, Kings, San Luis Obispo, Fresno, Madera, and Merced; and that cattle now in said counties may be moved to points outside of the quarantined area for purposes other than immediate slaughter upon inspection and certification that they are free of infection, by a duly authorized officer of the county board of supervisors, and that said certificate be approved and signed by the State veterinarian. This privilege is granted upon condition that the board of supervisors in each of said counties adopt and enforce efficient measures to prevent the introduction into and the dissemination within the county of the contagion of southern cattle fever, and that it prosecute measures for the eradication of said disease.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 2 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of Texas (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of Texas has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the intersection of the southern boundary of New Mexico with the international boundary line at the Rio Grande River; thence southeasterly along the said international boundary line to the southwest corner of the county of Pecos; thence following the western boundary of Pecos County to the southeast corner of Reeves County; thence following the boundary line between the counties of Pecos and Reeves to the Pecos River; thence southeasterly, following the Pecos River, to the northwest corner of Crockett County; thence east along the northern boundary of Crockett and Schleicher counties to the southeastern corner of Irion County; thence north along the eastern boundary of Irion County to the northeast corner of said county; thence continuing due north to the southern boundary line of Coke County; thence west with the southern boundary of Coke County to the southwest corner of Coke County; thence north along the western boundary of Coke County to the southern boundary of Mitchell County; thence east to the southeast corner of Mitchell County; thence north along the eastern boundary of Mitchell County to the northeast corner of said county; thence east along the southern boundaries of Fisher and Jones counties to the southeast corner of Jones County; thence north along the eastern boundary of Jones County to the northeast corner of said county; thence east along the southern boundary of Haskell County to the southeast corner of said county; thence north along the western boundary lines of Throckmorton and Baylor counties to the northwest corner of Baylor County; thence east along the southern boundary of Wilbarger County to the southeast corner of said county; thence north along the eastern boundary of Wilbarger County to the Red River; thence continuing in a northwesterly direction along the course of said river and the northern boundary of Texas to the southeast corner of Greer County, Oklahoma Territory.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Texas to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Texas by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

It is further ordered, That, during the continuance of the above line, no cattle originating in the quarantined area as described in B. A. I. Order No. 121, as modified, shall be moved or allowed to move into the counties of Baylor and Throckmorton and that portion of the county of Pecos lying north and west of the line described as follows: Beginning at the west line of Pecos County, at the point where the roadbed of the G. H. and S. A. Railroad crosses said line; thence in an easterly direction with the center of said roadbed to a point on section No. 36, block A2, G. H. and S. A. Railroad Company; thence north with the pasture fence running in a northerly direction through the eastern part of sections Nos. 13 and 12 of said block A2, and across section 1, G. C. and S. F. Railroad Company; thence continuing north with said pasture fence through the eastern part of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, M. K. and T. E. Railroad Company; thence continuing in a northerly direction to a point on the north line of section No. 6, block 160, G. C. and S. F. Railroad Company, same being corner of pasture fence; thence east with the north line of sections Nos. 6, 9, 10, 11, 12, 15, 16, block 160, G. C. and S. F. Railroad Company, to the northeast corner of said section No. 16, same being corner of pasture fence; thence in a northerly direction with the east boundary line of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, C. C. S. D. and R. G. N. G. Railroad Company, to the northeast corner of said section 32; thence west with the north boundary line of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, C. C. S. D. and R. G. N. G. Railroad Company, corner of fence; thence north with the east boundary line of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, C. C. S. D. and R. G. N. G. Railroad Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No. 9, patented to James E. Evans; thence north with the east line of said section No. 9 to the northwest corner of section No. 100, block A2, T. C. Railroad Company; thence east with north boundary line of said sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, T. C. Railroad Company; thence north with the east boundary line of sections Nos. 90, 91, 92, and 93, to the southeast corner of section No. 94, block A2, T. C. Railroad Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28, to the northeast corner of section No. 29, block C4, G. C. and S. F. Railroad Company; thence west with the north boundary line of said section No. 29 to the northwest corner of said section; thence northwest

diagonally across section No. 1, T. C. Railroad Company, section No. 97, block No. 194, G. C. and S. F. Railroad Company, to the northeast corner of said section No. 96; thence in a northerly direction across section No. 94 to a point on its north boundary line 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, G. C. and S. F. Railroad Company, to a point on the north boundary line of said section No. 58; thence northwesterly with the pasture fence, through section No. 59, to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, H. and G. N. Railroad Company; thence north with the east line of said section 17 to the Pecos River; thence northwesterly with said Pecos River to the northwest corner of Crockett County.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Haskell, Stonewall, Jones, Fisher, Scurry, Garza, Borden, Howard, Mitchell, Glasscock, Sterling, Irion, West Tom Green, Upton, Crane, Throckmorton, and Baylor, and that portion of the county of Pecos as described above, to any of that territory in the State of Texas lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the State of Texas, and upon written permission by such officer. No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantined district (except as provided for immediate slaughter) unless they have been duly inspected and passed, and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which said cattle are destined.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 3 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the Territory of Oklahoma (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the Territory of Oklahoma has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Red River at the southeastern corner of the county of Greer; thence northerly, following the course of the North Fork of the Red River to its intersection with the southern boundary line of Roger Mills County; thence east along the southern boundary lines of Roger Mills and Washita counties to the southeast corner of Washita County; thence north along the eastern boundary lines of Washita and Custer counties to the Canadian River; thence in a southeasterly direction along the course of said river to the southeast corner of Canadian County; thence north along the eastern boundary line of Canadian County to the northwest corner of Cleveland County; thence east along the northern line of Cleveland County to the middle of the right of way of the Atchison, Topeka and Santa Fe Railway; thence northerly following the middle of said right of way through Oklahoma, Logan, Noble, and Payne counties, and the Otoe, Missouri, and Ponca Indian reservations to the northern boundary of the Ponca Indian Reservation; thence east along the northern boundary of the Ponca Indian Reservation to the Arkansas River; thence in a northerly direction following the course of the said river to its intersection with the thirty-seventh parallel of north latitude at the southern boundary line of Kansas.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the Territory of Oklahoma to enforce said quarantine line, therefore the above quarantine line is adopted for the Territory of Oklahoma by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

It is further ordered, That, during the continuance of the above line, no cattle shall be moved or allowed to move from the counties of Greer, Roger Mills, Washita, Custer, Canadian, and that part of the counties of Oklahoma, Logan, and Payne, and of the Otoe, Missouri, and Ponca Indian reservations lying west of the right of way of the Atchison, Topeka and Santa Fe Railway, to any of that part of the Territory of Oklahoma lying west and north of said line, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the Territory of Oklahoma, and upon written permission by such officer, nor to any State or Territory outside of the quarantined district (except as provided for immediate slaughter), unless they have been duly inspected and passed, and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which destined.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 4 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of Tennessee (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of Tennessee has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning on the Mississippi River at the southeast corner of the State of Missouri at the western boundary of Tennessee; thence southerly along the western boundaries of the counties of Dyer and Lauderdale; thence following the main channel of the Mississippi River (leaving island No. 37 to the north and west) to the northwestern corner of Shelby County on the Mississippi River; thence easterly along the northern boundary lines of Shelby and Fayette counties to the southwestern corner of Haywood County; thence northerly and easterly along the western and northern boundary lines of Haywood County to the northeastern corner of said county; thence easterly along the northern boundary line of Madison County to the southwest corner of Carroll County; thence northerly and easterly along the western and northern boundary lines of Carroll County to the northeast corner of said county; thence southerly along the eastern boundary of said county to its intersection with the N. C. and St. L. Railway; thence easterly along the middle of the roadbed of said railway through Benton County to the intersection of said N. C. and St. L. Railway with the Tennessee River at the eastern boundary of Benton County; thence south along the eastern boundaries of Benton and Decatur counties to the northwest corner of Wayne County; thence easterly along the northern boundary line of Wayne County to the southwest corner of Lewis County; thence north along the western boundary of Lewis County to the northwest corner thereof; thence east along the northern boundary of said county to the northeast corner thereof; thence south along its eastern boundary to the boundary line of Lawrence County; thence east along the northern boundary of Lawrence County to the northeast corner thereof; thence south along the eastern boundary of Lawrence County to the southeast corner thereof; thence east along the southern boundary of Giles County to the Elk River; thence northeasterly along said river through Giles and Lincoln counties to the eastern boundary of Lincoln County; thence northerly and easterly along the western and northern boundaries of Moore County to the northeast corner of Moore County; thence north along the western boundary lines of Coffee and Cannon counties to the northwest corner of Cannon County; thence northeasterly and southeasterly along the northern and eastern boundaries of Cannon County to the boundary of Warren County; thence easterly along the northern boundary of Warren County to the western boundary of White County; thence northeasterly and southeasterly along the western and northern boundaries of White County to the western boundary of Cumberland County; thence southerly, easterly, and northeasterly along the western, southern, and eastern boundaries of Cumberland County to the northern corner of Rhea County; thence southerly along the eastern boundary lines of Rhea and James counties to the northwest corner of Bradley County; thence northerly and southeasterly along the northern boundary lines of Bradley and Polk counties to the northeast corner of Polk County; thence south along the eastern boundary line of Polk County to the southeast corner thereof at the southwestern corner of North Carolina.

That portion of the quarantine line of the State of Virginia described in the order of January 15, 1904 (amendment No. 7 to B. A. I. Order No. 121), beginning at the southwestern corner of Virginia (Lee County) and extending east along the southern boundary line of Virginia to the southeastern corner of Washington County, is hereby suspended during the enforcement of the above line for the State of Tennessee.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Tennessee to enforce said quarantine line, therefore the above line is adopted for the State of Tennessee by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 5 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of Georgia (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of Georgia has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the intersection of the western boundary line of Union County with the boundary line between the States of Georgia and North Carolina; thence southerly along the western boundary of Union County to the southwest corner thereof; thence northeasterly and easterly along the southern boundary lines of Union and Towns counties

to the western corner of Rabun County; thence easterly, southeasterly, and northeasterly along the western, southern, and eastern boundaries of Rabun County to the northeast corner of said county on the boundary between Georgia and North Carolina.

That portion of the quarantine line for the State of North Carolina described in the order of January 15, 1904 (amendment No. 6 to B. A. I. Order No. 121), beginning at the intersection of the northwest corner of Union County, Ga., with the State line, extending east along the southern boundary line of North Carolina to the northeast corner of Rabun County, is hereby suspended during the enforcement of the above line for the State of Georgia.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of Georgia to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Georgia by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 6 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of North Carolina (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of North Carolina has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the southwest corner of the county of Cherokee; thence east along the southern boundary lines of the counties of Cherokee, Clay, Macon, Jackson, Transylvania, and Henderson to the southwest corner of the county of Polk; thence northerly along the western boundaries of Polk and Rutherford counties to the southern boundary of McDowell County; thence westerly, northerly, and northeasterly along the southern, western, and northern boundaries of McDowell County to the North Fork of the Catawba River; thence southerly along the course of said North Fork to the Catawba River; thence easterly along the course of said river to the southwestern corner of Alexander County; thence north along the western boundary of said county to the southern boundary of Wilkes County; thence northwesterly along the boundary line of Wilkes County to the western corner of said county; thence following the western and northern boundary line of Wilkes County to the western portion of Surry County; thence northeasterly along the western boundary line of Surry County to its intersection with the northern boundary line of the State of North Carolina.

That portion of the quarantine line of the State of Virginia described in the order of January 15, 1904 (amendment No. 7 to B. A. I. Order No. 121), beginning at the southwestern corner of Grayson County and extending east along the southern boundary line of Virginia to the southeastern corner of said county, is hereby suspended during the enforcement of the above line for the State of North Carolina.

And whereas said quarantine line, as above set forth, is satisfactory to this Department, and legislation has been enacted by the State of North Carolina to enforce said quarantine line, therefore the above quarantine line is adopted for the State of North Carolina by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

It is further ordered, That during the continuance of the above line no cattle originating in the quarantined district, as described in B. A. I. Order No. 121 as modified, shall be moved or allowed to move into the counties of Surry, Wilkes, and those parts of Burke and McDowell south of the Catawba River and west of the North Fork of said river.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Surry, Wilkes, and those parts of Burke and McDowell south of the Catawba River and west of the North Fork of said river to any of that territory in the State of North Carolina lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the State of North Carolina, and upon written permission by such officer. No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantined district (except as provided for immediate slaughter), unless they have been duly inspected and passed and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which destined.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 7 TO B. A. I. ORDER NO. 121.)

Special Order Modifying Quarantine Line for the State of Virginia (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

In accordance with the regulations to prevent the spread of splenetic fever of cattle, the State of Virginia has agreed to establish and to cooperate in the enforcement of a quarantine line located as follows:

Beginning at the boundary line of Virginia at its southwestern corner (Lee County); thence east along the southern boundary of Virginia to the southwestern corner of Patrick County; thence northerly along the western boundaries of Patrick and Franklin counties to Daniels Run; thence easterly along Daniels Run and the Blackwater River to the Staunton River; thence in a southeasterly and northeasterly direction along the southern and eastern boundaries of Bedford County to the James River; thence following the James River to the southeastern corner of Charles City County; thence northerly and easterly along the western and northern boundaries of James City County to the western boundary of Gloucester County at the York River; thence southerly and northerly along the southern and eastern boundaries of Gloucester County to the northeastern corner of said county; thence easterly and southerly along the northern and eastern boundaries of Mathews County to the southeastern point of said county; thence south to the northern boundary of Elizabeth City County; thence westerly and northerly along the boundaries of Elizabeth City and Warwick counties to the James River; thence southeasterly along the course of the said river to the northwest corner of Norfolk County; thence south along the western boundary of said county to its intersection with the northern boundary of North Carolina; thence east along the southern boundaries of Norfolk and Princess Anne counties to the Atlantic Ocean.

And whereas said quarantine line as above set forth is satisfactory to this Department, and legislation has been enacted by the State of Virginia to enforce said quarantine line, therefore the above quarantine line is adopted for the State of Virginia by this Department for the period beginning with February 1, 1904, and ending January 31, 1905, in lieu of the quarantine line described in the order of January 14, 1904, for said area, unless otherwise ordered.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 8 TO B. A. I. ORDER NO. 121.)

Feeding Stations in the Quarantined District for Uninfected Cattle (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

It is hereby ordered, That cattle originating outside—north, east, and west of—the quarantined district, as defined in the order of January 14, 1904 (B. A. I. Order No. 121), and amendments thereto, and which are to be transported by rail through the quarantined district, may be unloaded for rest, feed, and water into uninfected pens set apart for such cattle at Polk Stock Yards and Union Stock Yards, Fort Worth, Tex.; Baird, Tex.; Southern Pacific Railway Stock Yards, Los Angeles, Cal.; Colton, Cal.; Bakersfield, Cal.; Salisbury, N. C., and at the Sapulpa Stock Yards of the St. Louis and San Francisco Railroad, Sapulpa, Ind. T.: *Provided,* That the cattle are free from southern cattle ticks and have not been unloaded at any other place within the quarantined district. They may, after unloading into said pens, be reloaded into the same cars from which unloaded, or into other cleaned and disinfected cars, and reshipped as uninfected cattle.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 9 TO B. A. I. ORDER NO. 121.)

Special Order Permitting Movement of Cattle from Two Northern Tiers of Counties in Arkansas (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 15, 1904.

It is hereby ordered, That B. A. I. Order No. 121, dated January 14, 1904, be amended so as to permit the shipment of cattle for purposes other than immediate slaughter from the two northern tiers of counties in the State of Arkansas into the noninfected area: *Provided,* That said cattle have remained in the above-described counties since January

1 of this year and have been inspected by officers of the Bureau of Animal Industry of this Department and found to be free of splenetic or Texas fever, and not to have been exposed to the contagion thereof; that proper facilities have been afforded for making such inspection; and that after inspection the cattle shall be shipped without delay and without exposure to the infection of splenetic or Texas fever: *Provided further,* That no cattle shall be allowed shipment under this order unless accompanied by a written permit issued by an inspector of the Bureau of Animal Industry, nor shall such cattle be taken into any State or Territory contrary to the local regulations, and said permission will be granted only for cattle which are to remain within the State to which destined for three months after arrival.

This order to remain in force until April 1, 1904.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 10 TO B. A. I. ORDER NO. 121.)

Special Order Regarding Quarantine of Cattle in Certain Counties in Tennessee and Kentucky (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 16, 1904.

It is hereby ordered, That, as the infection of Texas fever exists in certain counties in the States of Tennessee and Kentucky, no cattle shall be moved or allowed to move, except as provided for southern cattle for immediate slaughter, to any portion of the uninfected area from the counties of Clinton, Wayne, and Pulaski, in the State of Kentucky, and the counties of Pickett, Jackson, Overton, Fentress, Putnam, Dekalb, Clay, Cumberland, and that portion of Roane County lying north of the Tennessee and Clinch rivers and the western and northern parts of Carroll County, in the State of Tennessee, unless after inspection such cattle are found free of infection. This inspection must be made by duly authorized inspectors of the Bureau of Animal Industry of this Department, and movement allowed for other purposes than immediate slaughter only upon written permission by such inspectors.

The special order modifying the quarantine line for the State of Tennessee (amendment No. 4 to B. A. I. Order No. 121) is hereby modified in accordance with the above provisions.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 11 TO B. A. I. ORDER NO. 121.)

Special Order Permitting Movement of Cattle from Part of Ponca Indian Reservation.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., February 26, 1904.

It is hereby ordered, That section 3 of B. A. I. Order No. 121, dated January 14, 1904, be amended so as to permit the shipment of cattle for other purposes than immediate slaughter to points in the noninfected area from that portion of the Ponca Indian Reservation, Noble County, Okla., east of the right of way of the Atchison, Topeka and Santa Fe Railway, and bounded on the east and north by the Arkansas River and the Salt Fork of the Arkansas River: *Provided,* That said cattle have been kept in the above described area since January 1, 1904, and have been inspected by an officer of the Bureau of Animal Industry of this Department and found free of splenetic or Texas fever, and not to have been exposed to the contagion thereof: *And provided further,* That no cattle shall be allowed shipment from this area unless accompanied by a written permit issued by an officer of the Bureau of Animal Industry; and all such cattle shall be subject to the laws and regulations of the State to which destined. The cars in which such cattle are shipped must be free from infection and satisfactory to the officer supervising the shipment.

This order to terminate April 30, 1904.

JAMES WILSON, *Secretary.*

(AMENDMENT No. 12 TO B. A. I. ORDER No. 121.)

Special Order Regarding Quarantine of Cattle in Certain Counties in North Carolina.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 11, 1904.

It is hereby ordered, That the last two paragraphs of amendment No. 6 to B. A. I. Order No. 121, dated January 15, 1904, be amended to read as follows:

It is further ordered, That during the continuance of the above line no cattle originating in the quarantined district, as described in B. A. I. Order No. 121, as modified, shall be moved or allowed to move into the counties of Surry, Wilkes, Alexander, Yadkin, Catawba, Iredell, Davie, Rowan, Lincoln, Gaston, Polk, Cleveland, Rutherford, and those parts of Burke and McDowell south of the Catawba River and west of the North Fork of said river.

And it is further ordered, That no cattle shall be moved or allowed to move from the counties of Surry, Wilkes, Alexander, Yadkin, Catawba, Iredell, Davie, Rowan, Lincoln, Gaston, Polk, Cleveland, Rutherford, and those parts of Burke and McDowell south of the Catawba River and west of the North Fork of said river, to any of that territory in the State of North Carolina lying west and north of said counties, except after having been inspected and found free of infection by duly authorized inspectors of this Department or of the State of North Carolina, and upon written permission by such officer. No cattle from said counties shall be moved or allowed to move to any State or Territory outside of the quarantined district (except as provided for immediate slaughter), unless they have been duly inspected and passed, and permit issued by inspectors of this Department, nor until permission has been obtained from the proper officials of the State or Territory to which destined.

JAMES WILSON, *Secretary.*

(AMENDMENT No. 13 TO B. A. I. ORDER No. 121.)

Special Order Permitting the Movement of Cattle from a Part of Noble County, Okla.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 23, 1904.

It is hereby ordered, That section 3 of B. A. I. Order No. 121, dated January 14, 1904, be amended so as to permit the movement of cattle, for purposes other than immediate slaughter, from that portion of Noble County bounded on the north by the Otoe and Missouri Indian Reservation, on the east by Pawnee County, on the south by Payne County, and on the west by the right of way of the Atchison, Topeka and Santa Fe Railway, to any of that part of the Territory of Oklahoma lying west and north of the quarantine line as modified by amendment No. 3 to B. A. I. Order No. 121, after having been inspected and found free of infection by a duly authorized inspector of this Department, or of the Territory of Oklahoma, and upon written permission by such officer, and to any State or Territory outside of the quarantined district after having been duly inspected and passed, and permit issued by an inspector of this Department.

And provided further, That all cattle shipped from the above-described area shall be subject to the laws and regulations of the State or Territory to which destined, and that the cars in which they are shipped are free from infection and satisfactory to the officer supervising the shipment.

JAMES WILSON, *Secretary.*

(AMENDMENT No. 14 TO B. A. I. ORDER No. 121.)

Special Order Permitting Movement of Cattle from Part of Ponca Indian Reservation.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 6, 1904.

It is hereby ordered, That section 3 of B. A. I. Order No. 121, dated January 14, 1904, be amended so as to permit the shipment of cattle for purposes other than immediate slaughter to points in the noninfected area from that portion of the Ponca Indian

Reservation, Noble County, Oklahoma, east of the right of way of the Atchison, Topeka and Santa Fe Railway, and bounded on the east and north by the Arkansas River and the Salt Fork of the Arkansas River: *Provided,* That this amendment shall apply only to the cattle which are now held in the above-described area and that such cattle shall be duly inspected by an officer of the Bureau of Animal Industry of this Department and be found free of splenetic, or Texas, fever infection, and not to have been exposed to the contagion of this disease: *And provided further,* That no cattle shall be allowed shipment from this area except as southern cattle unless accompanied by a written permit issued by an officer of the Bureau of Animal Industry; and all such cattle shall be subject to the laws and regulations of the State to which destined. The cars in which such cattle are shipped must be free from infection and satisfactory to the officer supervising the shipment.

WILLIS L. MOORE, *Acting Secretary.*

(AMENDMENT NO. 15 TO B. A. I. ORDER NO. 121.)

Regulations Concerning Cattle Transportation—Special Order Regarding Exhibit of Cattle at California State Fair (1904).

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 12, 1904.

It is hereby ordered, That cattle from that part of California quarantined on account of southern cattle fever may be exhibited at the California State fair at Sacramento, August 22 to September 3, 1904, provided they are shipped direct from point of origin to the fair grounds in clean and disinfected cars; that they are accompanied by a certificate issued by the State veterinarian stating that he has inspected the cattle before shipment and found them to be free from the Texas fever tick (*Boophilus annulatus*); that while at the fair grounds said cattle are not brought into contact with other cattle from the noninfected area; and that, when the exhibition is closed, said cattle shall be shipped direct from the fair grounds to the quarantined area.

The special order modifying the quarantine line for the State of California (amendment No. 1 to B. A. I. Order No. 121) is hereby modified in accordance with the above.

WILLIS L. MOORE, *Acting Secretary.*

(AMENDMENT NO. 16 TO B. A. I. ORDER NO. 121.)

Regulations to Prevent the Spread of Splenetic Fever of Cattle—Removal of Special Quarantine, Custer County, Okla.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., September 6, 1904.

It is ordered, That the portion of amendment No. 3 to B. A. I. Order No. 121, dated January 15, 1904, relating to the movement of cattle from Custer County, Okla., be, and the same is hereby, revoked.

Cattle from Custer County may, until further order, be moved without restrictions, but no cattle shall be moved or allowed to move from the counties of Greer, Roger Mills, Washita, Canadian, and that part of the counties of Oklahoma, Logan, and Payne, and of the Otoe, Missouri, and Ponca Indian reservations of Oklahoma, lying west of the right of way of the Atchison, Topeka and Santa Fe Railway, except as provided in the amendment named.

WILLIS L. MOORE, *Acting Secretary.*

(AMENDMENT NO. 17 TO B. A. I. ORDER NO. 121.)

Regulations to Prevent the Spread of Splenetic Fever of Cattle—Restrictions Modified.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 13, 1904.

It is hereby ordered, That section 3 of B. A. I. Order No. 121, dated January 14, 1904, providing for the movement of cattle from the quarantined district described by said order and amendments thereto, be amended as follows:

From November 1, 1904, to January 31, 1905, inclusive, cattle from said district may be moved for purposes other than immediate slaughter to the noninfected area within the States of Virginia, North Carolina, Tennessee, Texas, and California, and to the States of Missouri and Kansas, and the Territories of Arizona and New Mexico, as may be provided for in the regulations of these States and Territories, and after inspection and upon written permission by an inspector of the Bureau of Animal Industry or a duly authorized inspector of the State or Territory to which the cattle are destined. From November 1 to December 31, 1904, inclusive, cattle from said district may be moved to the noninfected area in the Territory of Oklahoma after inspection and upon written permission by an inspector of the Bureau of Animal Industry. In the absence of such inspection and permission all movement of cattle from the quarantined district to points outside of such district in the above-named States and Territories is prohibited, except as provided for immediate slaughter.

All cattle from the quarantined district destined to points outside of the States and Territories above named may be shipped without inspection between November 1, 1904, and January 31, 1905, inclusive, and without restrictions other than may be enforced by local regulations at point of destination.

The reshipment to any part of the States of Virginia, North Carolina, Tennessee, Texas, and California, and the Territory of Oklahoma, outside of the quarantined district, or to any part of the States of Missouri and Kansas and the Territories of New Mexico and Arizona, of any cattle which may have been moved under this order, except by permission of the proper authorities of the State or Territory to which destined, is hereby prohibited.

And it is further ordered, That all stock pens which may have been reserved for the use of cattle from the quarantined district, prior to November 1 next, shall not be used for receiving or storing cattle from the quarantined district which have been inspected and passed, nor for cattle originating outside of the quarantined district, except when such cattle are intended for immediate slaughter.

WILLIS L. MOORE, *Acting Secretary.*

Changes in Quarantine Line for 1904.

B. A. I. Order No. 121, dated January 14, 1904, and amendments Nos. 1 to 9, dated January 15, 1904, and amendment No. 10, dated January 16, 1904, make a few alterations in the quarantine line as shown on the map published in January, 1903. These alterations, which can be readily made by anyone having the map, are as follows:

In North Carolina: That part of McDowell County north of the Catawba River and east of the North Fork of the Catawba River is taken out of the quarantined district, the line following the North Fork of the Catawba River and the Catawba River.

In Tennessee: Lewis County is placed in the quarantined area, the line following the western, northern, and eastern boundaries of Lewis County.

In California: Monterey County is removed from the quarantined district, the line following the southern boundary of Monterey County to its southwest corner, thence northeast along its eastern boundary to the southeastern extremity of San Benito County.

Special quarantine is placed upon certain counties as follows:

In Tennessee: Clay, Cumberland, and that part of Roane County north of the Tennessee and Clinch rivers.

In California: San Luis Obispo County.

Special quarantine is removed from certain counties as follows:

In Oklahoma: That part of Noble County west of the Atchison, Topeka and Santa Fe Ry., and that part of Blaine County north of the Canadian River.

(B. A. I. ORDER NO. 122.)

Special Order Regarding Exhibit of Cattle at Oklahoma Fat Stock Show, Oklahoma City, Okla.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., January 30, 1904.

It is hereby ordered, That cattle from the area quarantined on account of southern cattle fever by B. A. I. Order No. 121, dated January 14, 1904, and amendments thereto, may be shipped for exhibition and sale at the Oklahoma Fat Stock Show, to be held at Oklahoma City, Okla., February 23 to 25, 1904, provided they are shipped direct from point of origin to the exhibition grounds in clean and disinfected cars, and that they are accompanied by a certificate issued by an inspector of the Bureau of Animal Industry stating that he has inspected the cattle before shipment and found them to be free from the Texas fever tick (*Boophilus annulatus*).

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 123.)

Regulations to Prevent the Spread of Scabies (Mange, or Scab) in Cattle.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., March 18, 1904.

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

In furtherance of the regulations for the suppression and extirpation of contagious and infectious diseases among domestic animals in the United States, dated March 10, 1903 (B. A. I. Order No. 106), notice is hereby given that a contagious disease known as scabies, or mange, exists among cattle in the United States, and in order to prevent the dissemination of this disease and to aid in its eradication, the following regulations are established and observance thereof required:

1. It is required of everyone intending to ship or to trail cattle to ascertain that the cattle are not affected with scabies and have not been exposed to the contagion thereof before offering them for transportation or before crossing State or Territorial boundaries. Transportation companies are required to provide cleaned and disinfected cars or other vehicles for the reception of cattle, and to refuse for shipment cattle whose freedom from disease and from exposure to contagion is in doubt. Cattle that are not affected with scabies and that have not been exposed to the contagion may be shipped or trailed without restriction, except as may be provided by other regulations of this Department or such as may be lawfully imposed by the authorities of the State or Territory to which destined, or unless they are in a locality where inspection and certification are required by this Department before their removal therefrom.

2. Cattle that are affected with scabies, or that have been exposed to the contagion of scabies, either through contact with infected herds or infected premises, pens, or cars, shall not be shipped or driven from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia, or into public stock yards or feeding stations, until they have been dipped in a mixture approved by this Department, except as provided in rule 4.

3. Cattle that are affected with the disease may be shipped for immediate slaughter after one dipping, but if they are intended for feeding or stocking purposes they shall be held for a second dipping ten to twelve days after the first one. All of the cattle in a certain herd or shipment in which the disease is present shall be considered as affected with the disease.

4. Cattle that are not affected with the disease, but which have been exposed to the contagion, may be shipped for feeding or stocking purposes after one dipping, but may be shipped for immediate slaughter without dipping.

5. When affected cattle are shipped for slaughter after one dipping, and when exposed cattle are shipped for slaughter without dipping, the cars conveying them shall be marked on each side with a card bearing in plainly visible letters the words "Scabby cattle," or "Exposed cattle," as the case may be; and each of the waybills, conductor's manifests,

and bills of lading of such shipments by cars or boats shall have a similar statement plainly written or stamped upon its face. Said cards shall be furnished and affixed by the railroad company and shall not be removed until the cars have been cleaned and disinfected.

6. The dip now approved is the lime and sulphur dip, made in the proportion of 8 pounds of unslaked lime and 24 pounds of flowers of sulphur to 100 gallons of water. Weigh both the lime and sulphur. Place the unslaked lime in a mortar box or some suitable vessel and add enough water to slake the lime and form a lime paste or lime putty. Sift into this lime paste the flowers of sulphur and stir the mixture well. To make 100 gallons of dip, place the sulphur and lime paste in a kettle or boiler with about 30 gallons of boiling water and boil the mixture for two hours at least, stirring the liquid and sediment; add water when necessary to maintain the quantity. Pour the mixture and sediment into a large tub or barrel placed near the dipping vat and provided with a bunghole about 4 inches from the bottom, and allow it ample time (from two to three hours, or more if necessary) to settle. The use of some kind of a settling tank provided with a bunghole is an absolute necessity, unless the boiler is so arranged that it may be used for both boiling and settling. When fully settled, draw off the clear liquid into the dipping vat and add enough warm water to make 100 gallons. A double precaution against allowing the sediment to enter the vat is to strain the liquid through ordinary bagging as it is drawn from the barrel or settling tank. The same directions apply to larger quantities of dip, proportionate amounts of ingredients being used.

7. The dipping must be done thoroughly; the cattle must be kept in the dip between two and three minutes and be completely submerged twice. The dip must be maintained as nearly as possible at a temperature of 105° F. while the cattle are in it. It must be changed as soon as it becomes filthy, regardless of the number of cattle dipped in it, and in no case shall it be used when more than one week old. In emptying the dipping vat the entire contents must be removed, including all sediment and droppings or other foreign matter. The Department assumes no responsibility for loss or damage resulting from the dipping.

8. Suitable dripping platforms and drying pens shall be provided. In cold weather cattle shall not be dipped unless they can be kept in a warm pen until dry. Cattle shall not be loaded until they have become dry.

9. Where large numbers of cattle in a district are ready for transportation, inspectors of the Bureau of Animal Industry will make inspections and give certificates for cattle found free from disease and not to have been exposed to the contagion and for cattle dipped under their supervision. Certificates will also be given at feeding stations and stockyards where inspectors may be stationed.

10. Cattle shipped under a certificate are not guaranteed uninterrupted transit, for in the event of the development of scabies or exposure to it en route they shall then be handled as affected or exposed cattle, and the cars or other vehicles and the chutes, alleys, and pens that may have been occupied shall be cleaned and disinfected.

11. Public stockyards shall be considered as infected and the cattle yarded therein as having been exposed to the disease, and no cattle may be shipped out without being dipped, with the exception noted in rule 4. Where, however, a part of the stockyards is set apart for the reception of uninfected shipments of cattle and is kept free of disease, cattle may be shipped from such part without dipping. If, by chance, affected cattle are introduced into such reserved part, they shall be immediately removed therefrom and the chutes, alleys, and pens used by them thoroughly cleaned and disinfected. No cattle may be shipped for feeding or stocking from any stockyards where an inspector of the Bureau of Animal Industry is stationed without a certificate of inspection or of dipping given by him.

12. Cars and other vehicles, yards, pens, sheds, chutes, etc., that have contained affected or exposed cattle shall be cleaned and disinfected immediately after the cattle are removed therefrom.

13. Cleaning and disinfection shall be done by first removing all litter and manure and then saturating the interior surfaces of the cars and the woodwork, flooring, and ground of the chutes, alleys, and pens with a 5 per cent solution of crude carbolic acid in water, with sufficient lime to show where it has been applied.

14. Violation of this order is punishable by a fine of not less than $100 nor more than $1,000, or by imprisonment not exceeding one year, or by both fine and imprisonment.

15. B. A. I. Order No. 114 is hereby revoked.

J. H. Brigham, *Acting Secretary.*

(AMENDMENT NO. 1 TO B. A. I. ORDER NO. 123.)

Regulations to Prevent the Spread of Scabies (Mange, or Scab) in Cattle.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., July 16, 1904.

In consequence of the inability of the Department to begin the work of inspection and of supervising the dipping of cattle at an earlier date and of the inadequate facilities for dipping now available, and in view of the great losses which would be sustained by the owners of cattle in States where cattle mange, or scabies, is prevalent should they be compelled to hold all cattle for dipping or to ship all of them for slaughter as exposed animals, *it is ordered:*

1. That the requirements of B. A. I. Order No. 123 be, and they are hereby, modified to allow shipment until November 30, 1904, as hereinafter specified, with the expectation that before said date vigorous measures will be taken by State authorities and stockmen to eradicate the disease through dipping all affected and exposed animals.

2. That fat cattle designed for slaughter originating in an infected section may be shipped to market centers or stock yards where this Department maintains inspection without dipping or placarding cars, provided they have first been inspected by an officer of the Bureau of Animal Industry and found free from all evidence of scabies. If it is decided afterwards to reship such cattle for feeding purposes or for export they must be dipped according to the regulations of this Department before leaving such stock yards.

3. That all cattle that are to be shipped from an infected locality into another State or Territory for stocking or feeding purposes must be inspected and dipped twice if showing disease and be dipped once if not showing disease, on account of exposure to contagion.

4. That all cattle from infected localities must be accompanied by a certificate of inspection or be refused shipment.

5. That cattle from an infected section shall not be trailed to other States or Territories without dipping and certification, and when trailed the inspector shall designate the route to be taken in each case.

6. That affected cattle may be dipped once under the supervision of an employee of the Bureau of Animal Industry and shipped for stocking or feeding purposes after satisfactory arrangements have been made for the second dipping en route at the required time after the first dipping, at a point where there is an inspector stationed and under his supervision. In all cases the cars, waybills, conductor's manifests, and bills of lading must be marked, showing the true condition of the animals.

7. That inspectors in the field must see all animals placed on board cars after inspection and certification. If, however, the inspector's services are immediately required at another point, such animals may be turned over to the railroad agent and placed in the railroad pens and locked up by the agent until loaded.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 124.)

Prohibition of the Importation of Hay and Straw from Continental Europe.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., April 28, 1904.

Pursuant to the authority conferred by the act of Congress of February 2, 1903, and in furtherance of section 8 of the regulations of March 10, 1903 (B. A. I. Order No. 106), and in consequence of the existence of foot-and-mouth disease among animals in continental Europe:

It is hereby ordered, That, on account of the danger to the live-stock industry of the United States through the introduction of foot-and-mouth disease by means of the contagion being carried upon straw and hay, the importation of straw or hay the product of any country of continental Europe, or which has been transported through any of said countries, be prohibited: *Provided,* That this order shall not be construed to forbid the loading upon any vessel carrying animals from said countires for importation into the United States of a sufficient quantity of hay and straw for food and bedding for such animals, said hay and straw being the product of a country not affected by this order.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 125.)

Rules and Regulations for the Inspection of Live Stock and their Products.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 27, 1904.

The following rules and regulations are hereby prescribed for the inspection of live cattle, sheep, and hogs, and their carcasses, by virtue of the authority conferred upon the Secretary of Agriculture under the provisions of the act of Congress approved March 3, 1891, entitled "An act to provide for the inspection of live cattle, hogs, and the carcasses and products thereof which are the subjects of interstate commerce, and for other purposes," and amendment thereto approved March 2, 1895, and will supersede all former regulations for the inspection of live stock and their products:

1. Proprietors of slaughterhouses, canning, salting, packing, or rendering establishments engaged in the slaughtering of cattle, sheep, or swine, or the packing of any of their products, the carcasses or products of which are to become subjects of interstate or foreign commerce, shall make application to the Secretary of Agriculture for inspection of said animals and their products.

2. The said application shall be made in writing, addressed to the Secretary of Agriculture, Washington, D. C., and shall state the location of the slaughterhouse or other establishment, the address of the owner or agent of the same, the kind of animals slaughtered, the estimated number of animals slaughtered per week, and the character and quantity of the products to go into local, interstate, or foreign commerce from said establishment; and the said applicant in his application shall agree to comply strictly with all lawful regulations, orders, and instructions that may be made by the Secretary of Agriculture or the Chief of the Bureau of Animal Industry for carrying on the work of inspection at such establishment.

3. The Secretary of Agriculture will give said establishment an official number by which all its inspected products shall thereafter be known, and this number shall be used by the inspectors of the Department of Agriculture and also by the owners of said establishment to mark the products of the establishment as hereinafter prescribed.

4. The Secretary of Agriculture will designate an inspector to take charge of the examination and inspection of animals and their products at each establishment which has been officially numbered, and will detail to said inspector such assistant inspectors or other employees as may be necessary to carry on properly the work of inspection at said establishment. The inspector and all employees under his direction shall have full and free access to all parts of the premises and buildings used in the slaughter of animals and the conversion of their carcasses into food products.

(*a*) The Department assumes the right to inspect all animals slaughtered in establishments that have been granted inspection, and no carcasses, parts of carcasses, or meat products which can not, by marks, brands, labels, or transfer slips, be identified as having been duly inspected and passed by an officer of the Department shall be allowed to enter such establishment.

(*b*) The slaughtering of animals shall be conducted on week days between the hours of 6 a. m. and 7 p. m., except in certain cases of emergency, when permission to slaughter at other hours may be granted by the inspector in charge. No slaughtering shall be conducted on Sundays after 12 o'clock noon. Permission to make any permanent departure from the above-designated hours shall be obtained from the Chief of the Bureau of Animal Industry.

(*c*) The managers of abattoirs shall inform the inspector in charge or his assistant when slaughtering has been concluded for the day and the hour at which it will begin on the following day. In the meantime no slaughtering shall be done, except that when it is necessary, on account of injuries or other extraordinary causes, to kill animals during the night or at times other than the established hours, the same will be permitted, provided the carcasses of all such animals (with the thoracic viscera attached and all other viscera identifiable) shall be held for inspection and be duly identified to the inspector or his assistant by an employee of the abattoir; and provided further that an official of the abattoir company shall furnish promptly to the inspector or his assistant a signed statement showing the whole number of each kind of animal so slaughtered.

(*d*) Each commissioned employee engaged in inspection under these regulations will be furnished with a numbered badge, which shall be worn in a conspicuous manner while in the performance of his official duties and which shall not be allowed to leave his possession.

ANTEMORTEM INSPECTION.

5. An antemortem examination shall be made of all animals arriving at the public stock yards and intended for slaughter at abattoirs at which this Department has established inspection when said animals are weighed, or if not weighed this inspection shall be made in the pens. All animals found upon antemortem examination to be affected with any of the diseases or conditions named below shall be marked by placing in the ear a metal tag bearing the words "U. S. Rejected" and a serial number, or by such other marks as may be necessary to insure their identification:

(*a*) Hog cholera.
(*b*) Swine plague.
(*c*) Anthrax, or charbon.
(*d*) Rabies.
(*e*) Malignant epizootic catarrh.
(*f*) Pyemia and septicemia.
(*g*) Mange, or scab (unless the animals are satisfactorily dipped).
(*h*) Actinomycosis, or lumpy jaw.
(*i*) Pneumonia, pleurisy, enteritis, peritonitis, and metritis.
(*j*) Texas fever.
(*k*) Tuberculosis.
(*l*) Hemorrhagic septicemia.
(*m*) Blackleg.
(*n*) Animals in an advanced stage of pregnancy (showing signs of preparation for parturition) or which have recently (within ten days) given birth to young.
(*o*) Any disease or injury which, causing elevation of temperature or affecting the system of the animal, will make the flesh unfit for human food.
(*p*) Animals too young and immature to produce wholesome meat.
(*q*) Animals too emaciated and anemic to produce wholesome meat.
(*r*) Animals which are badly bruised, injured, or show tumors, abscesses, or suppurating sores.

Such rejected or condemned animals shall at once be removed by the owners from the pens containing animals which have been inspected and found to be free from disease and fit for human food, and shall be disposed of in accordance with the laws, ordinances, and regulations of the State and municipality in which said rejected or condemned animals are located and under the supervision of an inspector of the Department.

When animals so tagged are taken to an official establishment for slaughter, they shall be accompanied by a permit signed by the inspector in charge of the yards; this permit shall, upon the arrival of the animals at the abattoir, be delivered to the inspector on postmortem duty at the time, and the animals shall be duly identified by an employee of the abattoir to such inspector on the killing floor and before the skins are removed.

When animals are not inspected in the public stock yards the inspector in charge of an establishment or his assistant shall carefully inspect all animals in the pens of said establishment about to be slaughtered, and no animal shall be allowed to pass to the slaughtering room until it has been so inspected.

Animals rejected when showing signs of preparation for parturition shall not be slaughtered, nor for ten days after parturition. Pregnant and parturient animals may be removed by permit for stock or dairying purposes except when they are affected with or have been exposed to the contagion of any disease.

POSTMORTEM INSPECTION.

6. The inspector or his assistant shall carefully inspect at the time of slaughter all animals slaughtered at said establishment and make a postmortem report of the same to the Department. The head, tail, caul, or fat inclosed in the omentum of the animal and the entire viscera shall be retained in such manner as to preserve their identity until after the postmortem inspection has been completed, in order that they may be identified in case of condemnation of the carcass. Should the carcass of any animal on said postmortem examination be found diseased or otherwise unfit for human food, it shall be marked with a condemnation tag, the same to be attached with wire and seal, and the diseased organs or parts thereof, if removed from the carcass, shall also be marked with a condemnation tag.

The condemnation tag shall accompany the condemned carcass or its parts into the tank.

7. All animals rejected on antemortem examination and all animals passed on antemortem examination which are slaughtered at official abattoirs, and are found upon postmortem examination to be affected with any of the diseases or conditions named below, shall be disposed of according to the following instructions. It is to be understood, however, that, owing to the fact that it is impracticable to formulate rules cover-

ing every case, and to designate at just what stage a process becomes loathsome or a disease becomes noxious, the final disposition of all those not specifically covered by these rules will be left to the judgment of the inspector in charge.

(*a* and *b*) *Hog cholera and swine plague.*—(1) Carcasses showing widely distributed lesions of hog cholera or swine plague shall be condemned.

(2) When the lesions in the carcass are slight and confined to either the skin, kidneys, bones, or lymphatic glands, or to any combination of two of the organs mentioned, the carcass may be passed, provided it is cut for packing purposes.

(3) When the lesions are well marked in more than two of the organs mentioned (skin, kidneys, bones, or lymphatic glands), the entire carcass shall be condemned and tanked for fertilizer.

(4) Carcasses which reveal lesions more pronounced than those described for carcasses that may be passed, but not so severe as the lesions described for carcasses that shall be condemned and tanked for fertilizer, may be rendered into lard, provided they are cooked by steam for four hours at a temperature not lower than 220° F.

(5) In inspecting carcasses showing lesions of the skin, bones, kidneys, or lymphatic glands due consideration shall be given to the extent and severity of the lesions found in the viscera.

(*c*) *Anthrax, or charbon.*—All carcasses showing lesions of this disease, regardless of the extent of the disease, shall be condemned and tanked, together with the hide, hoofs, horns, viscera, fat, blood, and all other portions of the animal. The killing bed upon which the animal was slaughtered shall be disinfected with a 5 per cent solution of carbolic acid, and all knives, saws, cleavers, and other instruments shall likewise be treated before being used upon another carcass.

(*d*) *Rabies.*—Carcasses of animals which showed symptoms of rabies before being slaughtered shall be condemned.

(*e*) *Malignant epizootic catarrh.*—The carcasses of animals affected with this disease and showing generalized inflammation of the mucous membranes with emaciation shall be condemned. If the lesions are restricted to a single tract, or if the disease shows merely local lesions, the carcass may be passed.

(*f*) *Pyemia and septicemia.*—All carcasses showing lesions of either of these diseases, especially in connection with suppurative or gangrenous wounds, inflammatory phenomena, etc., shall be considered as highly dangerous and shall be condemned.

(*g*) *Mange, or scab.*—The carcasses of animals affected with mange, or scab, in advanced stages, with indications of emaciation and malnutrition, shall be condemned. When the disease is slight and the carcasses are in good condition, they may be passed.

(*h*) *Actinomycosis, or lumpy jaw.*—(1) If the carcass is in prime condition and there is no evidence upon postmortem examination that the disease has extended from the primary area of infection (usually the head), it may be passed, provided the head, including the tongue, is condemned.

(2) The disposition of the carcasses of actinomycotic animals in which the disease has extended beyond the primary area of infection shall be made in accordance with the instructions relating to tuberculosis.

(*i*) *Pneumonia, pleurisy, enteritis, peritonitis, and metritis.*—Generalized inflammation of the lungs, pleura, intestines, peritoneum, or the uterus, whether in acute or chronic form, is sufficient to justify the condemnation of carcasses so affected.

(*j*) *Texas fever.*—The carcasses showing sufficient lesions to warrant the diagnosis of Texas fever shall be condemned.

(*k*) *Tuberculosis.*—"Generalized" tuberculosis refers to that form of the disease in which the bacilli have been disseminated through the blood and lymph, and in which a number of organs are affected. "Extensive" tuberculosis refers entirely to the amount of tuberculous matter and the number of tubercles, and may apply to a case which is confined to one of the body cavities.

(1) The carcass may be passed when the lesions are limited to one group of lymphatic glands or one other organ.

(2) The carcass may be passed when the lesions are limited to two groups of visceral lymphatic glands in either the thoracic or the abdominal cavity.

(3) The carcass may be passed when the lesions are limited to two visceral organs (other than lymphatic glands) in the thoracic or the abdominal cavity, provided the lesions are slight, calcified, and encapsulated.

(4) The carcass may be passed when the lesions are limited to one group of visceral lymphatic glands and one other organ in the thoracic or the abdominal cavity, provided the lesions in the affected organs are slight.

(5) The carcass may be passed when the lesions are confined to two groups of visceral lymphatic glands and one other organ in the thoracic or the abdominal cavity, provided the lesions are slight, calcified, and encapsulated.

(6) The carcass may be passed when the lesions are confined to the lungs, the cervical lymphatic glands, and one group of the visceral lymphatic glands of the thoracic cavity, provided the affection is slight and the lesions are calcified and encapsulated.

(7) The carcass shall be condemned when well-marked lesions are discovered in both the thoracic and the abdominal cavity.

(8) The carcass shall be condemned when the lesions are extensive in either the thoracic or the abdominal cavity.

(9) The carcass shall be condemned in any of the cases described in paragraphs 2, 3, 4, 5, or 6 of this section (*k*) when the lesions are in a state of advanced caseation or liquefaction necrosis or when there are well-marked indications of recent reinfection.

(10) The carcass shall be condemned when the lesions are found to be more widely distributed throughout the viscera than have been described for carcasses that may be passed.

(11) The carcass shall be condemned when in connection with any of the lesions described in paragraphs 1, 2, 3, 4, 5, or 6 of this section (*k*) other lesions than those mentioned in paragraph 6 of this section (*k*) (cervical glands) are found in the glands of the carcass outside of the viscera.

(12) The carcass shall be condemned when there are well-marked tubercular deposits on the peritoneum or pleura.

(13) Hog carcasses affected as follows may be rendered into lard, provided they are cooked by steam for four hours at a temperature of 220° F.:

(*a*.) When the lesions are located as described in paragraphs 2, 3, 4, 5, and 6 of this section (*k*), but are found to be in an advanced stage of caseation or liquefaction necrosis, or surrounded by hyperemic zones.

(*b*.) When the lesions are more widely distributed or more extensive than those described in paragraphs 2, 3, 4, 5, and 6 of this section (*k*) and yet are confined to the cervical lymphatic glands and the viscera, provided the visceral lesions are not extensively generalized or do not generally show caseation or liquefaction necrosis, and provided further, that there are no indications of extensive acute reinfection.

(14) The viscera of all tuberculous animals shall be condemned:

(*l*) *Hemorrhagic septicemia.*—The carcasses of animals affected with this disease are highly unfit for food, as the specific bacteria are found in the blood, and therefore the meat shall be condemned.

(*m*) *Blackleg.*—The meat of animals showing lesions of blackleg is not wholesome. It rapidly undergoes putrefactive changes and develops an unpleasant, rancid-butter-like odor. Such carcasses shall therefore be condemned.

(*n*) *Pregnancy and parturition.*—Carcasses of animals (cows, sows, and ewes) in an advanced stage of pregnancy or which recently gave birth to young (within ten days) shall be condemned and rendered into grease.

(*o*) *Any disease or injury,* such as traumatic pericarditis, generalized melanosis, pseudoleukemia, etc., which causes elevation of temperature or affects the system of the animal shall be considered as sufficient cause for the condemnation of the carcass.

(*p*) *Carcasses of animals too young and immature* to produce wholesome meat, all unborn and stillborn animals, also carcasses of calves, pigs, and lambs under four weeks of age, shall be condemned.

(*q*) *Carcasses of animals too emaciated or anemic* to produce wholesome meat and those carcasses which show a slimy degeneration of the fat or a serous infiltration of the muscles shall be condemned.

(*r*) *Any organ or part of a carcass* which is badly bruised or affected by malignant tumors, abscesses, suppurating sores, tapeworm cysts, or liver flukes shall be condemned.

(*s*) *Caseous lymphadenitis.*—When the lesions are limited to the superficial lymph glands or to a few nodules in an organ, involving also the adjacent lymph glands, and the carcass is well nourished, the meat may be passed after destroying the affected parts. If extensive lesions with or without pleuritic adhesions are found in the lungs, or if several of the visceral organs contain caseous nodules and the carcass is emaciated or anemic, it shall be condemned.

(*t*) *Parasitic ictero-hematuria.*—The carcasses of sheep affected with this disease should be considered in the same class as those affected with Texas fever and shall be condemned.

(*u*) *Hogs affected with urticaria* (diamond skin disease), *Tinea tonsurans, Demodex folliculorum,* or *erythema* may be passed after detaching and tanking the skin, if the carcass is otherwise fit for food.

(*v*) *Icterus.*—Carcasses showing an intense yellow or greenish-yellow discoloration after proper cooling shall be condemned. Those carcasses which exhibit a yellowish tint directly after slaughter but lose this discoloration on chilling may be passed for food.

(*w*) *Uremia.*—Carcasses which give off the odor of urine shall be condemned.

(*x*) All animals that die in abattoir pens shall be tanked as specified for condemned animals.

(*y*) In all cases where carcasses showing localized lesions of disease are passed or rendered into lard, the affected parts must be removed for tanking before the condemnation tag is taken from the carcass.

8. All abattoirs at which inspection is established shall provide a suitable room in which condemned carcasses and parts shall be held until such a time as the inspector or his assistant may be present to supervise the tanking thereof. Such room shall be arranged for locking with a padlock, which will be furnished by the Department, the key to the same to remain in the possession of the inspector or his assistant.

(*a*) If after inspection has been established a reasonable length of time the abattoir management does not provide a suitable retaining room of sufficient size, or fails to tank condemned carcasses regularly on the day of their condemnation, such condemned carcasses shall be saturated with kerosene, as described below, and locked on the rail pending their final disposition.

9. All condemned carcasses and parts shall be tanked as follows: After the lower opening of the tank has been sealed by an employee of the Department, the condemned carcasses and parts shall be placed in the rendering tank in the morning, and immediately a sufficient force of steam be turned into the tank to destroy effectually the meat for food purposes before the killing for the day is completed; or the condemned portions may be placed in the rendering tank at the close of the day, or when killing is suspended, and both ends of the tank sealed, after which steam shall be turned into the tank until the meat is destroyed. Wire-and-lead seals will be provided by the Department for sealing tanks.

(*a*) A sufficient quantity of low-grade offal (uteri, floor scrapings, trimmings from gutters' benches, skimmings from catch basins, unemptied intestines, omasa, paunches emptied but not washed, etc.) shall be tanked with all condemned carcasses (except those tanked for lard) to effectually render the ultimate product unfit for human food, or, if such offal can not be obtained, the carcasses may be thoroughly slashed with a knife, then saturated with kerosene, and placed in the tank.

(*b*) The seals of tanks containing condemned material shall be broken by an employee of the Department when the tank is emptied during regular hours, and at other times satisfactory arrangements for the breaking of such seals shall be made with the inspector in charge.

10. When an establishment has no facilities for thus destroying condemned carcasses, such carcasses shall be removed from the premises upon numbered permit issued by the inspector in charge to rendering works designated by him, and there destroyed under his supervision in the manner described above.

11. Carcasses may be taken to the cooling room after marking with the condemnation tag in cases where only a portion of the carcass is condemned, and when such portion can not be removed without damage to the carcass until it is properly chilled. After chilling, the condemned portions shall be cut out and removed to the tank or to the retaining room, as provided for whole carcasses. Condemned parts that can be removed without damage to the carcass shall be tanked as described above.

12. All condemned carcasses and parts shall be disposed of only in the presence of an employee of the Department, and the report of the disposition shall be made by him upon the blank form provided therefor.

13. Should the owners of condemned carcasses not consent to the foregoing disposition of them, then the inspectors shall attach to such carcasses or parts a condemnation tag by means of a wire-and-lead seal and brand the word "Condemned" upon each side and quarter or piece of such carcasses and communicate the facts to the Department. The seal so attached shall have the word "Condemned" impressed upon the one side and the letters "U. S. A." upon the reverse side. A record must be kept of the kind and weight of the carcasses, and they shall, under supervision of the inspector or his assistant, be removed from the abattoir; and said firm or corporation shall forward, through the inspector, to the Secretary of Agriculture, a sworn statement monthly giving in detail the disposition of the carcasses so condemned and, if the same have been sold, showing to whom, whether for consumption as food or otherwise, with what knowledge, if any, by the purchasers of their condemnation by this Department, and whether or not before such sale said carcasses have been cooked or their condition at the time of inspection by this Department altered, and, if so, in what way.

The inspectors shall, when authorized by the Secretary of Agriculture, give notice, by publication to the express companies and common carriers at the place of condemnation, of the fact of condemnation, giving the name of the owner of such carcasses or parts, the time and place of slaughter, the reason for rejection, and a description of the carcasses or parts, and warn them not to transport such carcasses out of the State.

14. All persons are warned against removing the tags, seals, brands, or labels from condemned carcasses or parts, and are notified that they will be prosecuted under the act of Congress approved March 3, 1891, and amended March 2, 1895, for any such attempt to tamper with the devices for marking condemned carcasses or parts of carcasses as prescribed by the preceding regulation.

15. Carcasses or parts of carcasses which leave an official establishment for local, interstate, or export trade shall be marked by the inspector, or an employee designated by him, with a numbered label or brand, issued by the Department for this purpose, and a record of the same shall be sent to the Chief of the Bureau of Animal Industry.

(*a*) Carcasses or parts of carcasses which go into the cutting room of an abattoir or are used for canning purposes shall not be labeled. Those which are to be shipped from one abattoir to another for canning or other purposes shall not be labeled.

(*b*) Inter-abattoir shipments shall be made in cars sealed and tagged on both sides and the inspector in charge of the abattoir at destination shall be notified of the shipment, including the numbers and initials of the cars and the routes traversed by them. Cars which contain other than inspected meat shall not be sealed, and cars which contain stamped packages or labeled meat shall also not be sealed.

Managers of abattoirs shall give due notice to the inspector or his assistant of all intended shipments and of all expected receipts of meat in cars, and no meat or meat products shall be received at an official establishment unless the inspector or his assistant has full knowledge concerning the same.

(*c*) The seals upon cars in which meat is received at official abattoirs may be broken when it is necessary to unload such cars during the absence of the inspector or his assistant, provided the seals which are removed, together with a memorandum of the initials, number, and contents (pieces and weight) of each car, be promptly delivered by the owners or managers of the abattoir to the inspector or his assistant.

16. Each article of food product, whether in cans, barrels, firkins, kits, boxes, canvas, or other wrappers, made from inspected carcasses, shall bear a label containing the official number of the establishment from which said product came and also a statement that the same has been inspected under the provisions of the act or acts of Congress pertaining thereto.

(*a*) A copy of said label shall be filed at the Department of Agriculture, Washington, D. C., and after filing said label will become the mark of identification showing that the products to which it has been attached have been inspected, as provided by these rules and regulations; and any person who shall forge, counterfeit, alter, or deface said label will be prosecuted under the penalty clause of section 4 of the act of March 3, 1891, as amended by the act of March 2, 1895.

(*b*) When hot branding irons or other instruments are used to imprint hams, bacon, or other product with the name of the packer or trade-mark, and it is desired in addition to indicate that the meat has been inspected by the Department of Agriculture, the wording for this purpose, and which shall be in letters of sufficient size to be legible, shall be as follows: "No.[a] U. S. Insp'd," or "Abt.[a] U. S. Insp'd."

(*c*) All packages, such as barrels, boxes, firkins, kegs, etc., to be shipped from an official establishment to any foreign country shall have printed or stenciled on the side or on the top by the packer or exporter the following:

FOR EXPORT:

(1) Official number of establishment.
(2) Number of pieces or pounds.
(3) Shipping marks.
(4) Inspected according to act of Congress [b] ——— ———.

In case said package is for transportation to some other State or Territory or to the District of Columbia, in place of the words "For export" the words "Interstate trade" shall be substituted.

(*d*) The letters and figures in the above print shall be of the following dimensions: The letters in the words "For export" or the words "Interstate trade" shall not be less than three-fourths of an inch in length and the other letters and figures not less than one-half inch in length. On packages too small to contain the words of the dimensions given smaller letters may be used. In such cases the letters and figures affixed shall be black and legible and shall be in such proportion as the inspector in charge may designate.

17. The inspector in charge of said establishment, if satisfied that the articles in said packages came from inspected animals and that they are wholesome, sound, and fit for

[a] Insert official number of establishment.

[b] In the blank space following the word "Congress" the date of the act under which the inspection is made shall be inserted.

human food, shall cause to be pasted upon said packages meat-inspection stamps bearing serial numbers.

18. In order that the stamps may be protected, and to insure uniformity in affixing, inspectors shall require of the proprietors of abattoirs and packing establishments the adoption of cases suitable for one of the two methods mentioned below:

(*a*) The stamp may be affixed in a grooved space let into the box, of sufficient size to admit it, similar to that required by the Internal Revenue Bureau for the stamping of packages of plug tobacco.

(*b*) Stamps may be placed on either end of the box, provided that the sides are made to project at least one-eighth of an inch to afford the necessary protection from abrasion.

(*c*) Proprietors of abattoirs shall supply all the necessary help to affix the stamps, which shall be done under the supervision of an employee of the Department.

(*d*) Packages for export shall not be stamped until they are ready for shipment.

19. The stamps shall be canceled under the supervision of the inspector in charge by the use of a rubber stamp having five parallel waved lines. At the top of said rubber stamp shall be the name of the inspector in charge and at the bottom the abattoir number. The imprinting from this rubber stamp shall be with durable ink across the stamp and in such a manner as not to make the reading matter of the stamp illegible. The stamp, having been affixed and canceled, shall be covered immediately with a coating of transparent varnish or other similar substance.

20. No stamps, tags, seals, labels, etc., shall be issued by the inspector except to employees of the Department designated by him to supervise the affixing of said stamps, etc., to inspected products; and each employee having charge of this work shall be held personally responsible for the stamps, tags, seals, labels, presses, etc., issued to him, and shall make an accurate daily report to the inspector of the use of such supplies.

(*a*) No stamps, tags, labels, etc., shall be allowed to remain loose about the office or the abattoirs, and inspectors are instructed to use such additional safeguards as in their judgment will be necessary properly to account for every stamp, tag, label, etc., issued by them, and to have the work of affixing so carefully supervised that nothing but inspected products will be marked.

(*b*) Any stamps, tags, labels, or seals damaged or not used shall not appear upon the reports as having been affixed to inspected articles, but be returned to the inspector in charge, and a report made as to the reasons for their return.

21. Whenever any package of meat products bearing the inspection stamp shall have been opened and its contents removed for sale, the stamp on said package shall be obliterated.

22. Reports of the work of inspection carried on in every establishment shall be daily forwarded to the Department by the inspector in charge on such blank forms and in such manner as may be specified by the Chief of the Bureau of Animal Industry.

23. The inspector in charge shall promptly notify the Department of any changes in the firm names of the official establishments at his station.

Whenever an abattoir suspends slaughtering operations, the inspector shall promptly notify the Department of all employees whose duties are affected by such suspension, and forward his recommendation as to the number to be furloughed without pay. During said suspension only such employees shall be retained as are actually necessary to supervise the shipments of inspected products from the abattoir.

24. The inspector in charge of an establishment shall issue a certificate of inspection for all carcasses of animals or the food products thereof which are to be exported to foreign countries, which certificate shall cite the name of the shipper, the date upon which the stamps were affixed to packages, and the name of the consignee and destination. Said certificate shall also show the numbers of the stamps or labels attached to the articles to be exported and the shipping marks, and will be issued in serial numbers and in triplicate form. One certificate only will be issued for each consignment, unless otherwise directed by the Chief of the Bureau of Animal Industry.

Both the original and duplicate certificates shall be delivered to the exporter. The original is to be attached by him to the bill of lading accompanying the shipment for the information of the customs authorities, and shall be delivered to the chief officer of the vessel upon which said consignment is to be transported and continue with the shipment to destination. The duplicate shall be forwarded by the consignor to the consignee, to be used by the latter in identifying the shipment at the point of destination by comparison with the original.

(*a*) All names, marks, or stamp or label numbers, and other writing of any description made upon the certificate of inspection shall be copied on the stub of the book of certificates and be duly signed by the inspector. This stub constitutes the third copy of the certificate and shall be preserved and forwarded to the Department.

MICROSCOPIC INSPECTION.

25. A microscopic examination for trichinæ shall be made of all swine products exported to countries requiring such examination.

(*a*) No microscopic examination will be made of hogs slaughtered for interstate trade, but this examination shall be confined to those intended for the export trade, and only at abattoirs which export pork products to countries requiring a certificate from this Government to secure the admission of such products; the certificate shall cite the name of the consignor, etc., as specified in section 24.

(*b*) The purple meat-inspection stamp and certificate shall be used only for packages containing products of hog carcasses which have been microscopically examined for shipment to countries requiring such examination; these stamps shall be affixed only by an employee of the Bureau of Animal Industry and must be placed in grooved spaces as provided by paragraph (*a*), section 18, and covered with tin. Stamps upon barrels need not be placed in grooved spaces, provided tins having raised centers one-eighth of an inch high, the size of stamps, are used. The tins placed over stamps must be large enough to cover them entirely.

All stamps upon other packages shall be arranged as provided by section 18.

26. The microscopic inspection of pork intended for export to countries requiring such inspection shall be conducted as follows: The inspector in charge or his assistant shall take from each carcass a sample consisting of three specimens—one from the pillar of the diaphragm, one from the psoas muscle, and one from the inner aspect of the shoulder; when the tongue is retained for exportation, a specimen shall also be taken from the base of that organ. These specimens shall be placed in a small tin box and a numbered tag placed upon the carcass from which they were taken, a duplicate of said tag being placed in the sample box. The small boxes shall be placed in a large tin box provided with a lock. The boxes containing the samples from carcasses so tagged shall be taken to the microscopist, who shall thereupon cause to be made a microscopic examination of each sample, and shall furnish a written report to the inspector in charge, giving the result of said microscopic examination, together with the numbers of all carcasses affected with trichinæ.

(*a*) The samples of pork microscopically examined shall be classified as follows:

Class A.—Samples in which there are no signs of trichinæ, living or dead, calcified cysts, or other bodies or substances having any resemblance to trichinæ or trichinæ cysts.

Class B.—Samples in which there are disintegrated trichinæ or trichinæ cysts, calcified trichinæ or trichinæ cysts, or bodies having any resemblance thereto.

Class C.—Samples in which there are living or dead trichinæ bodies not disintegrated.

27. All carcasses reported by the microscopist to the inspector as affected with trichinæ (Class C) shall be removed from the cooling room under the supervision of said inspector or that of some other reliable employee of the Department, and shall be disposed of in accordance with the provisions of section 9; or they may be rendered into lard at a temperature of not less than 220° F.; or made into cooked-meat products if the temperature is raised to the boiling point a sufficient time to cook thoroughly the interior of the pieces.

Carcasses belonging to Class B shall be rejected for shipment to countries requiring microscopic inspection. All meat belonging to Class C and which is to be cured before being cooked shall be marked with twine and seals supplied for that purpose.

28. Separate cellars shall be provided in which microscopically inspected meats shall be cured, stored, packed, and stamped, and no other meats shall be cured, stored, packed, or stamped therein. These cellars shall be so arranged that they can be locked securely and the keys to the same shall remain in the possession of a trusted employee of the Department, who will lock and unlock the cellars as the business requires. He shall also be present during the time that the cellars remain unlocked, and keep an accurate account of all meats going into and from such cellars.

(*a*) Before the cutting of microscopically inspected carcasses is commenced all carcasses which have been either condemned or rejected shall be removed from the rail upon which the passed carcasses are hanging, and after the passed carcasses have been cut and disposed of the condemned and rejected ones shall be disposed of in accordance with these regulations.

The cutting of carcasses which have been passed shall be done under the personal supervision of an employee of the Department. Before the cutting is commenced all benches, chutes, etc., shall be cleaned of all other meats. When it is finished a stop shall be made to clear away all meats before the cutting of other hogs is begun.

(*b*) The greatest diligence shall be exercised at official establishments in the handling of sausage, brawn, and other products of a similar nature that are prepared from microscopically inspected meats. Such sausage shall be kept in separate compartments provided with locks the same as other microscopically inspected meats, and shall also be

prepared in separate rooms and cut up in choppers used only for such sausage. An absolutely correct record shall be kept by weight of all such meats, in order to prevent any but passed products being used.

(*c*) Whenever it is necessary to remove hams, shoulders, sausage, or other microscopically inspected meats from their respective compartments for smoking or other preparation, a separate smokehouse or compartment shall be provided, or each piece shall be marked by a seal affixed by an employee of the Department.

COOPERATION WITH MUNICIPAL AUTHORITIES.

29. At all cities where inspection is established inspectors are requested to notify the municipal authorities of the character of the inspection and to cooperate with such authorities in preventing the entry of condemned animals or their products into the local markets.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 126.)

Regulations to Prevent the Spread of Maladie du Coït of Horses.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., June 28, 1904.

To managers and agents of railroads and transportation companies of the United States, stockmen, and others:

Notice is hereby given that an infectious venereal disease of horses, known as maladie du coït, exists in portions of the counties of Dawes, Sheridan, and Cherry, lying north of the Chicago and Northwestern Railroad (formerly the Fremont, Elkhorn and Missouri Valley Railroad), in the State of Nebraska, and in the Pine Ridge and Rosebud Indian reservations, and the counties of Custer and Fall River, in the State of South Dakota.

You are informed that under the provisions of an act of Congress approved May 29, 1884, entitled "An act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals," and an act of Congress approved February 2, 1903, entitled "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes," and of B. A. I. Order No. 106, dated March 10, 1903, it is a violation of law to receive for transportation or to transport any horses affected with said disease from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia; or to deliver for such transportation any horses knowing them to be affected with said disease; or to drive on foot or transport in private conveyance from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia any horses knowing them to be affected with said disease; and under authority conferred by the said statutes—

It is hereby ordered: 1. That no horses shall be offered for shipment or be transported, or driven, or trailed, or otherwise removed from the reservations, counties, or portions of counties within the above-named boundaries, unless they shall have been previously inspected for that purpose by an inspector of the Bureau of Animal Industry of this Department and shall be accompanied by the certificate of inspection issued by said inspector. The owners or shippers for whom the inspection is made shall provide such facilities and render such assistance as may be required by the inspector.

2. That any animal or animals showing symptoms of the disease above mentioned, or known to have been exposed thereto, shall, in the discretion of an inspector or other employee of this Department, be immediately quarantined, and shall be maintained in quarantine, at the expense of the owner or owners, until released by the inspector or condemned and slaughtered as hereinafter provided.

3. No stallions shall be allowed to run at large on the Pine Ridge and Rosebud Indian reservations in the State of South Dakota; and all stallions not castrated on the said reservations shall be tagged as hereinafter provided.

4. That there shall be no breeding of horses in herds on the said reservations in which there is an animal which has been exposed to the infection of maladie du coït, at any time within 18 months of said exposure.

5. That in order to prevent the dissemination and to aid in the extermination of maladie du coït the inspector is authorized to pay for any horse so condemned and slaugh-

tered not more than its actual value based upon its serviceableness for work at the time of purchase. When, however, the owner or owners will not accept the indemnity price offered, the inspector shall arrange for a board of three appraisers, who shall determine the price to be paid for the condemned animals. This board shall be constituted as follows: An inspector or other employee of the Bureau of Animal Industry, one person chosen by the owner of the animal or animals to be appraised, and the third member to be chosen by the two herein provided for. The animal or animals under condemnation shall be maintained in quarantine at the expense of the owner or owners until disposed of.

6. Any stallions found running at large on the Pine Ridge and Rosebud Indian reservations on and after date of this order may be castrated by an inspector or other employee of the Bureau of Animal Industry of this Department, or by such other person as may be duly authorized by the inspector in charge in the district named, and no indemnity shall be allowed the owner in case of damage resulting from such castration. The term "stallion" shall be understood to apply to any uncastrated male horse 1 year of age or older.

7. Such stallions on the above-named reservations as shall be allowed to remain uncastrated shall each be given a numbered tag and shall be kept under such restrictions as the inspector in charge shall prescribe, and shall be subjected to examination at such times and as frequently as may be thought necessary by the said inspector, for the purpose of ascertaining whether symptoms of the said disease have developed.

8. The inspector of this Department is further authorized to pay a sum of $50 for authentic information leading to the discovery of a stallion affected with the contagious venereal disease known as maladie du coït, and a sum of $25 for authentic information as to the whereabouts and ownership of a mare affected with the above disease: *Provided,* That when such information is received from more than one person as to the location of the same animal and owner the sum above named shall be paid to the first informant, and when doubt exists or a dispute arises as to who was the first informant no reward shall be paid: *Provided further,* That when more than one affected animal is found belonging to the same owner or on the same premises only one reward shall be paid.

All persons engaged in raising horses, or dealing in, or in driving or shipping horses, and all transportation companies, are requested to cooperate with this Department in enforcing the law and preventing the spread of said disease.

Inspectors are instructed to report all violations of this order.

Violation of these regulations is punishable by a fine of not less than $100 nor more than $1,000, or by imprisonment not more than one year, or by both such fine and imprisonment.

This order supersedes B. A. I. Order No. 102 and its amendment.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER NO. 127.)

Rules and Regulations Prescribed in Regard to "Renovated Butter," in Accordance with the Act of Congress Approved May 9, 1902, and Information Concerning "Adulterated Butter."

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 15, 1904.

The act of Congress approved May 9, 1902, and popularly known as "the oleomargarine law," assigned to the Secretary of the Treasury and the Secretary of Agriculture various duties concerning those grades and kinds of butter defined in the law as "adulterated butter" and "process or renovated butter." The two officers named accordingly formulated and approved the necessary rules and regulations for carrying into effect the provisions of the said law, and the same were published as a part of "Regulations No. 9, revised June, 1902, United States internal revenue."

The rules and regulations concerning renovated butter, and the duties of the Secretary of Agriculture in connection therewith, were first published from this office under date of June 21, 1902, and in an amended form under date of November 1, 1902.

These rules and regulations have now been revised by the joint action of the Secretary of the Treasury and the Secretary of Agriculture, under date of August, 1904.

The orders of June 21 and November 1, 1902 (being B. A. I. Orders No. 94 and No. 98), are hereby revoked, and in place thereof the following revision is hereby published for

the guidance of officers and employees of this Department and of all others concerned therewith. For general information certain matters are added relating to adulterated butter.

JAMES WILSON, *Secretary*.

RENOVATED BUTTER (OR "PROCESS BUTTER").

[Extracts from act of May 9, 1902.]

* * * * * * *

"SEC. 4. That for the purpose of this act 'butter' is hereby defined to mean an article of food as defined in 'An act defining butter, also imposing a tax upon and regulating the manufacture, sale, importation, and exportation of oleomargarine,' approved August second, eighteen hundred and eighty-six;[a] that 'adulterated butter' is hereby defined to mean a grade of butter produced by mixing, reworking, rechurning in milk or cream, refining, or in any way producing a uniform, purified, or improved product from different lots or parcels of melted or unmelted butter or butter fat, in which any acid, alkali, chemical, or any substance whatever is introduced or used for the purpose or with the effect of deodorizing or removing therefrom rancidity, or any butter or butter fat with which there is mixed any substance foreign to butter as herein defined, with intent or effect of cheapening in cost the product, or any butter in the manufacture or manipulation of which any process or material is used with intent or effect of causing the absorption of abnormal quantities of water, milk, or cream; that 'process butter' or 'renovated butter' is hereby defined to mean butter which has been subjected to any process by which it is melted, clarified, or refined and made to resemble genuine butter, always excepting 'adulterated butter' as defined by this act."

That special taxes are imposed as follows:

"Manufacturers of process or renovated butter shall pay fifty dollars per year, and manufacturers of adulterated butter shall pay six hundred dollars per year. Every person who engages in the production of process or renovated butter or adulterated butter as a business shall be considered to be a manufacturer thereof."

* * * * * * *

"Every person who sells adulterated butter shall be regarded as a dealer in adulterated butter. And sections thirty-two hundred and thirty-two, thirty-two hundred and thirty-three, thirty-two hundred and thirty-four, thirty-two hundred and thirty-five, thirty-two hundred and thirty-six, thirty-two hundred and thirty-seven, thirty-two hundred and thirty-eight, thirty-two hundred and thirty-nine, thirty-two hundred and forty, thirty-two hundred and forty-one, and thirty-two hundred and forty-three of the Revised Statutes of the United States are, so far as applicable, made to extend to and include and apply to the special taxes imposed by this section and to the person upon whom they are imposed.

"That every person who carries on the business of a manufacturer of process or renovated butter or adulterated butter without having paid the special tax therefor, as required by law, shall, besides being liable to the payment of the tax, be fined not less than one thousand and not more than five thousand dollars; and every person who carries on the business of a dealer in adulterated butter without having paid the special tax therefor, as required by law, shall, besides being liable to the payment of the tax, be fined not less than fifty nor more than five hundred dollars for each offense.

"That every manufacturer of process or renovated butter or adulterated butter shall file with the collector of internal revenue of the district in which his manufactory is located such notices, inventories, and bonds, shall keep such books and render such returns of material and products, shall put up such signs and affix such number of his factory, and conduct his business under such surveillance of officers and agents as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may by regulation require. But the bond required of such manufacturer shall be with sureties satisfactory to the collector of internal revenue, and in a penal sum of not less than five hundred dollars; and the sum of said bond may be increased from time to time and additional sureties required at the discretion of the collector or under instructions of the Commissioner of Internal Revenue."

* * * * * * *

INSPECTION, MARKING, AND BRANDING SUBJECT TO REGULATIONS OF SECRETARY OF AGRICULTURE.

SEC. 5. All parts of an act providing for an inspection of meats for exportation, approved August thirtieth, eighteen hundred and ninety, and of an act to provide for the inspection of live cattle, hogs, and the carcasses and products thereof which are the subjects of interstate commerce, approved March third, eighteen hundred and ninety-one, and of amendment thereto approved March second, eighteen hundred and ninety-five, which are applicable to the subjects and purposes described in this section shall apply to process or renovated butter. And the Secretary of Agriculture is hereby authorized and required to cause a rigid sanitary inspection to be made, at such times as he may deem proper or necessary, of all factories and storehouses where process or renovated butter is manufactured, packed, or prepared for market, and of the products thereof and materials going into the manufacture of the same. All process or renovated butter and the pack-

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[a] The definition of "butter" referred to is the first section of the original oleomargarine law; it is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of this act the word "butter" shall be understood to mean the food product usually known as butter, and which is made exclusively from milk or cream, or both, with or without common salt, and with or without additional coloring matter.

ages containing the same shall be marked with the words "Renovated Butter" or "Process Butter" and by such other marks, labels, or brands and in such manner as may be prescribed by the Secretary of Agriculture, and no process or renovated butter shall be shipped or transported from its place of manufacture into any other State or Territory or the District of Columbia, or to any foreign country, until it has been marked as provided in this section. The Secretary of Agriculture shall make all needful regulations for carrying this section into effect, and shall cause to be ascertained and reported from time to time the quantity and quality of process or renovated butter manufactured, and the character and the condition of the material from which it is made. And he shall also have power to ascertain whether or not materials used in the manufacture of said process or renovated butter are deleterious to health or unwholesome in the finished product, and in case such deleterious or unwholesome materials are found to be used in product intended for exportation or shipment into other States or in course of exportation or shipment he shall have power to confiscate the same. Any person, firm, or corporation violating any of the provisions of this section shall be deemed guilty of a misdemeanor and on conviction thereof shall be punished by a fine of not less than fifty dollars nor more than five hundred dollars or by imprisonment not less than one month nor more than six months, or by both said punishments, in the discretion of the court.

[Extracts from the appropriation act of the Agricultural Department for the fiscal year ending June 30, 1905, approved April 23, 1904.]

* * * * * * *

* * * "*Provided,* That the Secretary of Agriculture may construe the provisions of the act of March third, eighteen hundred and ninety-one, as amended March second, eighteen hundred and ninety-five, for the inspection of live cattle and products thereof, to include dairy products intended for exportation to any foreign country, and may apply, under rules and regulations to be prescribed by him, the provisions of said act for inspection and certification appropriate for ascertaining the purity and quality of such products, and may cause the same to be so marked, stamped, or labeled as to secure their identity and make known in markets of foreign countries to which they may be sent from the United States their purity, quality, and grade; and all the provisions of said act relating to live cattle and products thereof for export shall apply to dairy products so inspected and certified."

RULES AND REGULATIONS PRESCRIBED IN REGARD TO "RENOVATED BUTTER" (OR "PROCESS BUTTER") IN ACCORDANCE WITH THE ACT OF CONGRESS APPROVED MAY 9, 1902.

1. As the terms "process butter" and "renovated butter" occur throughout the act as synonymous, the article will be designated as "renovated butter" in these regulations and in all correspondence relating thereto.

2. The following explanation of the definition of renovated butter as it occurs in the law has been prepared by the Department of Agriculture and is adopted for guidance in connection with these regulations:

(*a*) This grade or kind of butter may be made from one or more lots or parcels of butter which has been or have been "subjected to any process by which it is melted, clarified, or refined and made to resemble genuine butter, always excepting 'adulterated butter' as defined by this act."

(*b*) The butter to be subject to this definition must have been melted—that is, so affected by heat as to become of sufficient fluidity to move in a continuous stream of even consistency from one vessel to another by pouring or pumping, because butter can not be "clarified or refined" unless it be melted to that degree.

(*c*) The butter must, besides melting, have been subjected to some process by which it is "clarified or refined." Butter, or melted butter, may be clarified or refined by skimming, settling, aerating, washing, and other processes, through the action of heat, cold, agitation or motion, or rest.

(*d*) Butter thus melted and clarified or refined becomes an oil or fat almost free from taste and odor. To be again "made to resemble genuine butter" it must have restored to it the butter characteristics or similitude of texture, granulation, and flavor. For this purpose the processed or renovated butter is usually mixed with milk or skim milk, or buttermilk, or cream, sweet or sour, and granulated by cooling. It may or may not have common salt or artificial coloring added. To "resemble genuine butter" the article must have passed through these or other processes, subsequent to melting, so that it looks, smells, and tastes like "butter," having a similar appearance, consistency, texture, and flavor.

(*e*) It may be assumed that the object of subjecting a lot or lots of butter to such a process is to remove rancidity, sourness, mold, or other fault, or feature which has impaired its merchantable quality, or to otherwise renew or improve the product, so that the substance is truly "renovated," although such object is not expressed in the act.

(*f*) But if, in such process, "or in any (other) way," "any acid, alkali, chemical, or any substance whatever is introduced" or used, or if "there is mixed (therewith) any substance foreign to butter" (including any fat or oil other than butter fat), or if in any way the substance is made to hold "abnormal quantities of water, milk, or cream," the substance or commodity is to be recognized and treated as "adulterated butter" under this act.

(*g*) Renovated butter having 16 per cent or more of moisture will be held to contain "abnormal quantities of water, milk, or cream," and be, therefore, classed as "adulterated butter."

3. Section 4 of the act of May 9, 1902:

> Manufacturers of process or renovated butter shall pay fifty dollars per year * * *. Every person who engages in the production of process or renovated butter * * * as a business shall be considered a manufacturer thereof.

The special-tax year begins July 1. The special tax of manufacturers who commence business in the month of July will be reckoned for one year, and the tax of manufacturers who commence business after the month of July will be reckoned proportionately from the 1st day of the month from which the liability to special tax commenced to the 1st day of July following.

4. Every manufacturer of renovated butter, before commencing business (or at least within the month in which liability to special tax commenced), must register with the collector of the district in which the business is to be carried on, his name, or style, place of residence, business, and the place where such business is to be carried on, and procure a special-tax stamp at the rate of $50 per annum, which stamp he is to place and keep conspicuously posted in his establishment or place of business; and on the 1st day of July in each year he will again so register and procure a new special-tax stamp and post it as above stated.

5. Under the provisions of section 4 of said act the tax of one-fourth of 1 cent per pound imposed thereby on renovated butter is to be represented by coupon stamps, to be provided by the Commissioner of Internal Revenue, as authorized by existing laws. A fractional part of a pound shall be taxed as a pound.

6. For this purpose tax-paid stamps will be furnished in denominations of 10, 20, 30, 40, 50, 60, and 100 pounds, each stamp bearing nine coupons. Such stamps must contain the name of the collector, his district and State, and show thereon the date of payment of the tax, the number of pounds, and the number of the factory.

7. On the withdrawal of a package of renovated butter the proper tax-paid stamp must be affixed thereto by the manufacturer, by the use of adhesive material, and if the packages be of wood not less than five tacks must be driven through each stamp, one in each corner and one in the middle of the stamp. The stamp when so affixed must be immediately canceled. The blank spaces reserved for the manufacturer must be properly filled up by him in accordance with the plain requirements of the form of the stamp. This is not optional with the manufacturer, but a requirement. In the blank space in the lower left-hand corner of the stamp must be inserted the date when the stamp was affixed and canceled. This is required to be done before the renovated butter is removed from the factory. The date of issue must be entered on the stamp by the collector at the time the same is issued. For the purpose of cancellation the manufacturer will use a stencil plate or rubber stamp by which there shall be printed five parallel waved lines long enough to extend beyond each side of the stamp onto the package.

The printing on the stamp must be plain and distinct, and the waved lines must be fine enough to avoid obliterating the reading matter and figures contained in the tax-paid stamp. The imprinting must be with blacking or other durable coloring material, over and across the stamp, and in such manner as not to deface the stamp—that is, so as not to daub and make it illegible.

8. The stamp must be affixed to the side of the package, to a smooth surface, in such manner as to be readily canceled in the manner above described. When a package contains a number of pounds between 10 and 20, a 10-pound stamp with the necessary number of coupons attached will be issued to cover the net weight. Packages containing more than 20 pounds and less than 30 pounds will have attached a 20-pound stamp with a suitable number of coupons to represent the contents. Larger-sized packages will be similarly stamped.

9. Every manufacturer of renovated butter will be required to file with the collector a notice on Form No. 507, together with an inventory, Form No. 509, when making application for special-tax stamp as manufacturer. At the same time he will file a bond, Form No. 508, in a penal sum to be fixed by the collector of internal revenue for his district, but in no case less than $500.

Collectors of internal revenue will decline to approve the bond of a manufacturer of renovated butter until they are satisfied that the premises to be used for the manufacture of that article are entirely separate from these used for the manufacture of adulterated butter or oleomargarine, or for the handling or manipulation of butter not taxable under the act of May 9, 1902. (See Treas. Decisions No. 588, Oct. 6, 1902.)

10. Each manufacturer of renovated butter is required to keep books and make returns showing the quantity of materials received on the factory premises and the quantity of

finished materials removed therefrom. Sample pages of book (Form No. 511) to be kept by manufacturers will be furnished to collectors, but the book must be provided by the manufacturer, as the same is not supplied by the Government.

11. Form No. 499 has been prescribed for monthly returns of manufacturers of renovated butter, and such forms will be furnished through the collectors of internal revenue.

In preparing Form 499 manufacturers should note on pages 1 and 2 the quantities of materials used in producing renovated butter each day of the month and the quantity produced. On page 2 is a space provided for a special account of tax-paid renovated butter returned to the factory. On page 3 of this form, as well as "Form 499 inside page," should be noted the date when renovated butter is sold, removed, or destroyed, together with the amount by packages and pounds; also to whom sold or consigned, giving the name, place of business, residence, county, and State. A manufacturer of renovated butter can sell and report as sold on this form, if such be the case, his entire output of renovated butter each day to himself.

The last page of this form contains a recapitulation of the quantity of renovated butter produced and disposed of during the month, and the quantity on hand at the beginning and at the end of each month. This should be prepared with great care. The certificate in this form must be executed by the manufacturer or his duly authorized representative, and sworn to before a deputy collector or an officer authorized to administer oaths generally.

12. Collectors will give to each manufacturer of renovated butter in their respective districts a factory number, the numbers to be consecutive, and not thereafter changed. A new number should be given to a new factory unless it be the successor to some former manufacturer and factory, in which event it could retain the old number. The factory number applies to the manufacturer and his establishment rather than to the building.

13. Every manufacturer of renovated butter shall place and keep over the principal entrance of the factory wherein his business is carried on, so that it can be distinctly seen, a sign, with letters thereon not less than 3 inches in length, printed in oil colors or gilded, giving his full name and business and the number of his factory, as follows:

A——— B———,

MANUFACTURER OF RENOVATED BUTTER.

Factory No. ———.

14. Whenever any manufacturer's package of renovated butter is empty it will be the duty of the person who removes the contents thereof to utterly destroy the tax-paid stamp on such empty package. Any person having in his possession empty renovated butter packages, the tax-paid stamps on which have not been destroyed, will be liable to a heavy penalty.

On the 6th day of October, 1902, the following ruling was made by the Commissioner of Internal Revenue:

> It is now held that original packages of oleomargarine or renovated butter may be shipped from the manufactory or place of business of the wholesale dealer securely covered in such a manner as to protect the contents from injury, provided the words "Oleomargarine" or "Renovated butter," as the case may be, are plainly marked or stenciled on the outside of such wrapper or covering, on two sides thereof, opposite each other, in gothic letters not less than one-half inch square, and so placed as to be plainly visible and easily read.
>
> It must be understood that the use of such covering is permitted for the purpose only of protecting the packages and contents from injury while in transit, and the same should not be allowed to remain on the packages after they have reached their destination, or when in the hands of the retail dealer. Neither will storage in warehouses of stamped packages thus covered be permitted, but the covering, whatever it is, shall be placed on the packages at the time of shipment and no longer in advance thereof than actually necessary.

It shall be further understood that authority to ship original packages with the stamps, marks, and brands concealed will in no manner abridge the right of internal-revenue officers to examine such packages for the purpose of inspecting the stamps, marks, and brands thereon, or making other investigations.

The authority here given is merely experimental and will be withdrawn immediately upon evidence appearing that the concession is made use of for the purpose of evading the law or the deception of the public or the officers of internal revenue.

15. Attention is called to the fact that the act named makes no provision for the exportation, free of tax, of renovated butter, nor for drawback of tax on such articles when exported. Consequently, all renovated butter for export must be stamped and marked the same as for the domestic market.

The law neither defines nor imposes special taxes upon wholesale or retail dealers in renovated butter. Neither does it describe the manner of sale of such product by

dealers. However, renovated butter should always bear or be accompanied by the evidence that the manufacturer's tax thereon has been paid.

16. Section 5 of said act of May 9, 1902, requires that all renovated butter and the packages containing the same shall be marked with the words "Renovated butter" or "Process butter," and by such other marks, labels, or brands, and in such manner as may be prescribed by the Secretary of Agriculture. To carry this provision into effect, the Secretary of Agriculture prescribes the following rules for labeling, marking, and branding.

17. Every manufacturer's package of renovated butter shall have affixed thereto a label, on which shall be printed the number of the factory and the revenue district and State in which it is located, together with the following notice:

MANUFACTURER'S DECLARATION AND NOTICE.

Factory No. ———, ——— district, State of ———.

The manufacturer of the RENOVATED BUTTER[a] (or process butter) herein contained has complied with all the requirements of the law and regulations authorized thereby. Every person is cautioned not to use again, either this package for renovated butter or the tax stamp thereon, nor to remove the contents of this package without destroying said stamp, nor to remove, alter, or deface this notice or any of the required marks in connection therewith, under penalty provided by law in such cases.

This label or notice shall be printed in black, upon white paper, and shall be not less than 5 nor more than 7 inches long, and not less than 3 inches in width. The label must be securely affixed by paste to the side of the package and opposite or on a different side (not the top or bottom) from that to which the tax stamp is attached, and in such a way as to be exposed to view and easily read. After being affixed, this label must be covered with a coating of transparent and waterproof varnish or similar substance. The words "Renovated butter" in this notice must be printed in one or two lines and in plain gothic letters at least three-eighths inch square. There must also be plainly marked or stenciled on the outside of every package the gross, tare, and net weight in pounds.

If any manufacturer's package, bearing the revenue stamp, contains inner packages holding 4 pounds or more (such as 5-pound wooden boxes, or paper-board cartons), the label or notice prescribed by this rule must also be affixed, in like manner, to every one of such inner packages.

When a dealer in renovated butter sells to another dealer, for resale, renovated butter in subdivision packages of less than 10 pounds, the dealer so selling shall mark on each such unstamped package sold for resale the words "This is a subdivision taken from a properly stamped package of renovated butter." This notice should be printed directly on the package, or on a slip to be pasted thereon, and the letters must be of a size and shape to be conspicuous and easily read.

18. Renovated butter may be packed by the manufacturer thereof in firkins, tubs, or packages of wood or other suitable material not before used for that purpose; but each package must contain not less than 10 pounds, and when packed in a solid body or mass there shall be stamped or branded into the upper surface of the butter the words "Renovated butter" in one or two lines, the letters to be gothic style, not less than one-half inch square and depressed not less than one-eighth inch.

19. Manufacturers will be permitted to pack prints, bricks, or rolls of renovated butter not less than one-half pound each in weight; but each print, brick, or roll must have stamped thereon the words "Renovated butter," in two lines, the letters to be depressed, of gothic style, not less than three-eighths inch square, and sunken not less than one-eighth inch. The contents of any package less than 10 pounds, and including 5-pound boxes, will be treated the same as a brick or roll.

20. Renovated butter for export must be stamped and marked the same as for the domestic market. When prepared expressly for export to a foreign country and duly inspected and certified for export, the Secretary of Agriculture will authorize the manufacturer thereof, or the dairy inspector who issues the export certificate, to brand the product concerned, at the factory or at place of export, with the word "firsts," or "seconds," or "thirds," in addition to and closely following the word "butter," as prescribed by rule 18, and to place a similar mark or brand upon every package, closely following the label prescribed by rule 17; and when so marked or branded the additional word shall be in letters of the same style or kind as prescribed for the word "butter" in said rules, but at least one-third less in size. The Secretary of Agriculture will determine the word to be thus used in accordance with the inspection for export as duly made

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[a] NOTE.—See size and style required for these two words at this place, on page 593, Nos. 2 and 3.

and the quality of the product as thereby ascertained. (This additional branding will be done pursuant to existing law concerning dairy products for export and which authorizes the said Secretary to "cause the same to be so marked, stamped, or labeled as to secure their identity and make known in the markets of foreign countries to which they may be sent from the United States their purity, quality, and grade." See appropriation act for the Department of Agriculture, approved April 23, 1904, p. 4.)

21. Prints, bricks, or rolls, as provided by rule 19, may be packed in manufacturers' stamped packages with or without coverings, wrappers, or inner packages of paper, cloth, wood, or other material; but every cover or wrapper of every description must have the words "Renovated butter," in two lines, conspicuously marked, branded, stamped, or printed thereon in black or nearly black upon a white or light ground, in full-faced gothic letters not less than three-eighths inch square, and so placed as to be the only marking upon one side or surface of the inner parcel as packed. Upon wrappers usual for prints and rolls this marking must be placed by itself near the middle of the wrapper, and the latter so used that the designated name will be the most conspicuous marking upon the outside of the wrapped print or roll when removed from the stamped package. This rule applies to all cartons, their coverings and linings; also to all wooden boxes of 5 pounds, more or less.

22. No mark whatever shall be placed upon any form of renovated butter, in depressed characters, in addition to those prescribed by rules 18, 19, and 20. And no marks, labels, or brands in addition to those prescribed by the foregoing rules shall be placed upon renovated butter, nor upon the coverings, wrappers, or packages containing the same, with the sole exception of the shipping marks usual to commerce, unless duly and specifically authorized by the Secretary of Agriculture. Any manufacturer desiring to use additional marks upon coverings, wrappers, or packages of renovated butter may submit the same in print or other suitable design to the Secretary of Agriculture, who will, if approved, duly authorize the use of the same. Samples of all markings formally approved, and bearing such approval endorsed thereon, shall be kept on file at the factory to which they apply, for the convenient reference of inspectors and others, and no coverings, wrappers, cartons, or packages otherwise marked shall be used or kept for use or for any purpose in any factory subject to inspection.

23. All factories where renovated butter is manufactured, packed, or prepared for market, as well as the materials used and to be used, the processes and the products, will be inspected from time to time by officers or agents specially designated for that purpose by the Secretary of Agriculture. Inspectors will be required to report upon "the character and condition of the material" and "the quantity and quality" of the product in such manner as may be prescribed.

24. Renovated butter should not be removed or separated from the original package bearing the tax stamp and other prescribed marks when it is in transportation, the subject of interstate commerce, exported, or whenever and wherever offered for sale, until delivered to the consumer or purchaser in retail trade. And dealers, as well as all other persons, should note the special and heavy penalties prescribed by law for removing, altering, or defacing *any* of the marks placed upon renovated butter, its wrappings, packages, etc., pursuant to law and regulations, except as provided in rule 14 of this series. But these marks when upon bulk packages are necessarily destroyed in the course of retail trade, and retailers may prepare, for convenience of customers, not more than one day in advance of sales, small parcels and packages, marked for identification in accordance with regulations, provided such retail packages remain in, or stacked upon, or in contact with, the manufacturer's package originally containing the same until such contents have been bargained for and sold; provided that in so doing none of the required stamps and markings are concealed or effaced. Retail dealers should not keep renovated butter for sale in any form completely separated from and independent of the manufacturer's stamped package, because the absence of tax-paid stamps would be prima facie evidence of the nonpayment of the tax and subject the renovated butter to seizure on that ground.

25. Correspondence and all administrative details under the rules numbered 3 to 15, inclusive, above, are assigned to the Commissioner of Internal Revenue, Treasury Department. And, similarly, all matters under the rules 16 to 23, inclusive, are assigned to the Dairy Division, Bureau of Animal Industry, Department of Agriculture.

Approved:

L. M. SHAW,
Secretary of the Treasury.

JAMES WILSON,
Secretary of Agriculture.

REGARDING ADULTERATED BUTTER.

The following extracts from the Treasury Regulations refer mainly to adulterated butter:

[In explanation of the first part of section 4, act of May 9, 1902.]

The evident intent of this section is to define all products properly known or designated as butter, and to separate them into three classes for the purposes of the act. The first paragraph of the section adopts the definition of "butter" used in the act of August 2, 1886, as being "the food product usually known as butter, which is made exclusively from milk or cream, or both, with or without common salt, and with or without additional coloring matter."

All butter which does not come under the terms of this definition, therefore, necessarily falls into one of the other two classes upon which a tax is laid.

The next paragraph of the section defines "adulterated butter," the product which bears the higher rate of tax, in a long clause, which is evidently intended to describe with some particularity well-defined forms of adulteration as examples or guides.

Such are, *first,* "A grade of butter produced by mixing, reworking, rechurning in milk or cream, refining, or in any way producing a uniform, purified, or improved product from different lots or parcels of melted or unmelted butter or butter fat, in which any acid, alkali, chemical, or any substance whatever is introduced or used for the purpose or with the effect of deodorizing or removing therefrom rancidity;" *second,* "Any butter or butter fat with which there is mixed any substance foreign to butter as herein defined, with intent or effect of cheapening in cost the product, or any butter in the manufacture or manipulation of which any process or material is used with intent or effect of causing the absorption of abnormal quantities of water, milk, or cream."

Briefly stated, the first instance describes reworked or renovated butter to which a foreign substance has been added to "deodorize or remove rancidity;" the second instance describes butter cheapened in cost by admixtures or made to "contain abnormal quantities of water, etc." (So-called emulsified or milk-blended butter.)

The third paragraph of the section defines "process butter" or "renovated butter" essentially as butter which has been subjected to the processes generally used for the renovation of butter, but *without* the introduction or use of "any acid, alkali, chemical, or any substance whatever," and without being made to contain "abnormal quantities of water, milk, or cream."

It follows, therefore, that "renovated butter" is butter, as defined in the law of August 2, 1886, containing nothing foreign to that product, but which, having become impaired in quality, has been subjected to melting and other renovating processes.

ADULTERATED BUTTER DEFINED.

The definition of adulterated butter as contained in the act of May 9, 1902, embraces butter in the manufacture of which any process or material is used whereby the product is made to "contain abnormal quantities of water, milk, or cream," but the normal content of moisture permissible is not fixed by the act. This being the case, it becomes necessary to adopt a standard for moisture in butter, which shall, in effect, represent the normal quantity. It is therefore held that butter having 16 per cent or more of moisture contains an abnormal quantity and is classed as adulterated butter.

LADLED BUTTER.

The product commonly known as "ladled butter" is a grade of butter made by mixing and reworking different lots or parcels of butter so as to secure a uniform product. This is known by various names to the trade. This product will not be held to be renovated butter unless in addition to being reworked it is melted and refined. It will not be held to be adulterated butter unless materials foreign to statutory butter are added to it, or it is made to contain 16 per cent or more of water. Persons who engage in the production of "ladled" butter as a business will be held liable to special tax as manufacturers of renovated butter if they melt and refine their product, and to special tax as manufacturers of adulterated butter if they use in it substances foreign to statutory butter or produce a butter having 16 per cent or more of water. Persons who sell "ladled" butter which is adulterated will be liable to special tax as dealers in adulterated butter.

CREAMERY BUTTER.

Grades of butter produced in large establishments directly from milk or cream are known as creamery butter. The manufacturers of this butter will not be held liable to special tax unless they involve their product in one or the other rate of tax as set forth above with reference to "ladled" butter. The owners of such establishments must see that their product is statutory butter, and they must exercise particular care with reference to its water content.

WHEN PRODUCT IS OLEOMARGARINE.

The addition of small quantities of a foreign fat, lard, or oil to butter will render the product liable to tax as oleomargarine, and the producer thereof to special tax as manufacturer of oleomargarine.

WHEY BUTTER.

Whey butter is classed as adulterated butter when it contains 16 or more per cent of moisture.

SWEET BUTTER.

"Sweet," or unsalted, butter is made and sold to some extent, especially in the large cities. When made by reworking country butter it must necessarily fall under the classification of "renovated butter," as the salt can not be removed except by a process of melting and separating. If the product reaches or exceeds the limit of 16 per cent of water content, or if materials foreign to butter are added to it for the purpose or with the effect of removing rancidity or of cheapening the product, it will be classed as "adulterated butter," or as oleomargarine if foreign fats are added.

NOTE.—The complete regulations regarding "adulterated butter," as well as those for oleomargarine, may be obtained from the office of the Commissioner of Internal Revenue, Treasury Department, Washington, D. C.

SUPPLEMENTAL NOTICES AND INSTRUCTIONS.

In addition to the foregoing, all persons concerned should note that besides the penalties prescribed in the internal-revenue laws relating to special taxes and tax stamps, there are specific penalties named in the last sentence of section 5 of the act of May 9, 1902 (see p. 585), for violation of the provisions in that section for shipping and transporting "from its place of manufacture into any other State or Territory or the District of Columbia, or to any foreign country," renovated butter which has not been marked and prepared in all respects in accordance with the foregoing "needful regulations" duly made for carrying the said law into effect. And there are also specific penalties named in the acts of Congress referred to in the first sentence of said section 5, and which are thereby made applicable to renovated butter, for altering or destroying any marks placed thereon pursuant to law and regulations, or, in other words, for the violation of rule 24 on page 11.

Samples of the words "Renovated butter," as required by rules 17, 18, 19, and 21, will be found on the following page.

All inspectors, officers, or agents of the Department of Agriculture assigned to duty under this order will report promptly to the Secretary of Agriculture all violations of these regulations observed by them and all cases of failure fully to conform to the laws herein specified and the rules prescribed for their enforcement. Also, any case in which butter claimed to be "renovated" is believed to be "adulterated butter," in accordance with the legal definition thereof.

All inspectors, officers, or agents of the Department of Agriculture will at all times render every possible assistance to officers and agents of the Commissioner of Internal Revenue, Treasury Department, in the discharge of their duty under the act of May 9, 1902.

Instructions will be issued to agents of this Department from time to time regarding the inspection of factories, routes of transportation, and markets, and the reports to be rendered thereon. All such reports will be addressed to Dr. D. E. Salmon, Chief of the Bureau of Animal Industry.

JAMES WILSON, *Secretary.*

SAMPLE OF FULL-FACED GOTHIC LETTERS.

No. 1. One-half inch square.

RENOVATED
BUTTER

No. 2. Three-eighths inch square.

RENOVATED BUTTER

No. 3.

RENOVATED
BUTTER

(B. A. I. ORDER No. 128.)

Special Order Providing for the Importation of Canadian Cattle, Sheep, and Swine for Exhibition Purposes at International Live Stock Exposition, Chicago, Ill.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., August 16, 1904.

It is hereby ordered, That Canadian cattle may be imported into the United States for exhibition purposes at the International Live Stock Exposition, to be held from November 26 to December 3, 1904, at Chicago, Ill., without being subjected to the tuberculin test, provided they are accompanied by a certificate issued by a Canadian official veterinarian stating that such cattle are free from contagious and infectious diseases: *And provided further,* That the cattle which are not sold to remain in the United States shall be returned immediately to Canada at the close of the exposition.

The Department must be notified of any Canadian cattle that will remain in the United States, and the tuberculin test will be applied to them by an inspector of this Department before shipment to destination is allowed.

All Canadian cattle, sheep, and swine intended for this exposition must be shipped directly to the exposition grounds and must not be unloaded in any public stock yards.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER No. 129.)

Regulations Concerning the Importation of Hay and Straw from Continental Europe.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 4, 1904.

Under authority of the act of Congress entitled "An act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of live stock, and for other purposes," approved February 2, 1903, and to prevent the introduction of the contagion of anthrax, pleuro-pneumonia, or foot-and-mouth disease,

It is hereby ordered, That all hay or straw, the product of any country of continental Europe, or which has been transported through any of said countries, shall be disinfected as may be prescribed by the Chief of the Bureau of Animal Industry, at the expense of the importer, before being unloaded from the vessel bringing it into any port of the United States, and when unloaded and landed it shall be stored and held in quarantine for a period of not less than three months in some place acceptable to the Chief of the Bureau of Animal Industry and under conditions prescribed by him.

The order of April 28, 1904 (B. A. I. Order No. 124), prohibiting the importation of hay and straw, is hereby revoked.

JAMES WILSON, *Secretary.*

(B. A. I. ORDER No. 130.)

Regulations for the Certification of Associations of Breeders of Pure-bred Live Stock and Books of Record of Pedigrees.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 14, 1904.

In accordance with paragraph 473 of the act of Congress entitled "An act to provide revenue for the Government and to encourage the industries of the United States," approved July 24, 1897, authorizing the Secretary of Agriculture to "determine and certify to the Secretary of the Treasury what are recognized breeds and pure-bred animals," and amended by the act of Congress approved March 3, 1903, entitled "An act regulating the importation of breeding animals," the following regulations are hereby prescribed for the certification of associations of breeders of pure-bred live stock and books of record of pedigrees:

CERTIFICATION OF AMERICAN BOOKS OF RECORD.

1. Any association in the United States desiring certification by the Secretary of Agriculture to the Secretary of the Treasury, under the provisions of paragraph 473 of the act of July 24, 1897 (amended March 3, 1903), shall submit the following:

(*a*) If incorporated, with capital stock, a statement showing amount of capital stock and number of shares, the names of incorporators, names and residences of directors and officers, names and residences of shareholders with the amount of stock held by each, and a copy of its charter.

(*b*) If unincorporated, or if incorporated without stock, a statement showing the names and residences of officers and directors, and the names and residences of members. An association incorporated without capital stock shall submit a copy of its charter.

(*c*) Each association shall submit a copy of its constitution and by-laws and rules of entry, and copies of all blank forms used in the conduct of its business, such as applications for registry, certificates of registry, transfer, etc., a complete set of the published volumes of its book of record, and a statement of its financial condition on the 31st of December preceding date of application.

2. (*a*) Each certified association shall submit, on or before February 1, 1905, copies of the published volumes of its book of record, if such have not already been filed with the Department. If the association has not yet published a book of record, such a publication must be submitted on or before February 1, 1906, otherwise certification may be withdrawn. When a volume of the book of record is published, a copy shall be forwarded to the Department without delay. The Department advises that at least one volume be published annually; however, in cases where circumstances make it impossible to do this, a statement shall be submitted showing how often the book of record will be published, and this statement will be considered and acted upon according to its merits. The schedule so adopted shall be adhered to, but the interval allowed between the publication of any two volumes shall not exceed four years.

(*b*) On or before February 1st of each year, each certified association shall submit copies of its constitution, by-laws, rules of entry, and all blank forms used in the conduct of its business, such as applications for registry, certificates of registry and transfer, certificates for use in the importation or exportation of animals into and from the United States, etc., and a statement showing the names of foreign pedigree-record associations and books of record of pedigree with which it is affiliated, with the names and addresses of the secretaries of such associations and custodians of books of record.

(*c*) Should any association fail to act in conformity with any or all of these regulations, notice shall be sent at once to such association. Failure to comply within thirty (30) days after the sending of such notice, or to submit reasonable explanation for the delay, shall be regarded as sufficient ground for the withdrawal of the certification of the Secretary of Agriculture.

(*d*) Statements made under the provisions of these regulations shall be on oath by the secretary of each association.

(*e*) Each association in the United States which has, or may have, the certification of the Secretary of Agriculture shall hold all its books open to inspection by the Department at any time, should such inspection be deemed necessary.

CERTIFICATION OF FOREIGN BOOKS OF RECORD.

3. When the certification of a book of record published in a foreign country is requested, the custodian shall submit a complete set of the published volumes of said book of record to date of making application, with the indorsement of a certified association in the United States. The Department reserves the right, however, to be governed in all cases by the advice of representatives of the United States abroad, if the necessity for such a course exists.

4. Custodians of foreign books of record now on the certified list should supply volumes of their books of record needed to complete the Department sets and submit additional ones as issued.

OFFICIAL COMMUNICATIONS.

5. All books of record, official papers, reports, and other communications submitted under the provisions of these regulations should be addressed to the Chief of the Bureau of Animal Industry.

CERTIFIED ASSOCIATIONS.

6. The following American and foreign associations and books of record have been certified to the Secretary of the Treasury to date:

American books of record.

CATTLE.

Name of breed.	Book of record.	By whom published.
Aberdeen Angus	American Aberdeen Angus Herdbook.	American Aberdeen Angus Breeders' Association, Thos. McFarlane, secretary, Union Stock Yards, Chicago, Ill.
Ayrshire	Ayrshire Record	Ayrshire Breeders' Association, C. M. Winslow, secretary, Brandon, Vt.
Devon	American Devon Record	American Devon Cattle Club, L. P. Sisson, secretary, Newark, Ohio.
Dutch Belted	Dutch Belted Cattle Herdbook.	Dutch Belted Cattle Association, H. B. Richards, secretary, Easton, Pa.
Galloway	American Galloway Herdbook.	American Galloway Breeders' Association, C. W. Gray, secretary, Union Stock Yards, Chicago, Ill.
Guernsey	Herd Register of the American Guernsey Cattle Club.	American Guernsey Cattle Club, William H. Caldwell, secretary, Peterboro, N. H.
Hereford	American Hereford Record.	American Hereford Cattle Breeders' Association, C. R. Thomas, secretary, 225 West Twelfth street, Kansas City, Mo.
Holstein Friesian.	Holstein Friesian Herdbook	Holstein Friesian Association of America, Frederick L. Houghton, secretary, Brattleboro, Vt.
Jersey	Herd Register of the American Jersey Cattle Club.	American Jersey Cattle Club, J. J. Hemingway, secretary, 8 West Seventeenth street, New York, N. Y.
Polled Durham	American Polled Durham Herdbook.	American Polled Durham Breeders' Association, Fletcher S. Hines, secretary, Malottpark, Ind.
Red Polled	Red Polled Herdbook	Red Polled Cattle Club of America (Incorporated), J. McLain Smith, secretary, Dayton, Ohio.
Shorthorn	American Shorthorn Herdbook.	American Shorthorn Breeders' Association, John W. Groves, secretary, Union Stock Yards, Chicago, Ill.
Sussex	American Sussex Register	American Sussex Association, Overton Lea, secretary, Nashville, Tenn.
Brown Swiss (Schwytz).	Swiss Record	Brown Swiss Cattle Breeders' Association, N. S. Fish, secretary, Groton, Conn.

HORSES.

Name of breed.	Book of record.	By whom published.
American Trotter	American Trotting Register	American Trotting Registry Association, Wm. H. Knight, secretary, 355 Dearborn street, Chicago, Ill.
Belgian Draft	American Register of Belgian Draft Horses.	American Association of Importers and Breeders of Belgian Draft Horses, J. D. Conner, jr., secretary, Wabash, Ind.
Cleveland Bay	American Cleveland Bay Studbook.	Cleveland Bay Society of America, R. P. Stericker, secretary, 80 Chestnut avenue, West Orange, N. J.
Clydesdale	American Clydesdale Studbook.	American Clydesdale Association, R. B. Ogilvie, secretary, Union Stock Yards, Chicago, Ill.
French Coach	French Coach Studbook	French Coach Horse Society of America, S. D. Thompson, secretary, 503 Tacoma Building, Chicago, Ill.
French Draft	National Register of French Draft Horses.	National French Draft Horse Association, C. E. Stubbs, secretary, Fairfield, Iowa.
German Coach [a]	German, Hanoverian, and Oldenburg Coach Horse Studbook.	German, Hanoverian, and Oldenburg Coach Horse Association of America, J. Crouch, secretary, Lafayette, Ind.
Hackney	American Hackney Studbook.	American Hackney Horse Society, A. H. Godfrey, secretary, Townsend Building, New York, N. Y.
Morgan	American Morgan Register.	American Morgan Register Association, H. C. Shaw, recording secretary, Middlebury, Vt.
Oldenburg [b]	Oldenburg Coach Horse Register.	Oldenburg Coach Horse Association of America, C. E. Stubbs, secretary, Fairfield, Iowa.
Percheron	American Percheron Studbook.	American Percheron Horse Breeders and Importers' Association, Geo. W. Stubblefield, secretary, Union Stock Yards, Chicago, Ill.
Do	Percheron Register	The Percheron Registry Company, Chas. C. Glenn., secretary, Columbus, Ohio.
Saddle Horse	American Saddle Horse Register.	American Saddle Horse Breeders' Association, I. B. Nall, secretary, Louisville, Ky.
Shetland Pony	American Shetland Pony Club Studbook.	American Shetland Pony Club, Mortimer Levering, secretary, Lafayette, Ind.
Shire	American Shire Horse Studbook.	American Shire Horse Breeders' Association, Charles Burgess, secretary, Wenona, Ill.
Suffolk	American Suffolk Horse Studbook.	American Suffolk Punch Horse Association, Alex. Galbraith, secretary, Janesville, Wis.
Thoroughbred	American Studbook	The Jockey Club, James E. Wheeler, registrar, 571 Fifth avenue, New York, N. Y.

[a] See Oldenburg. [b] See German Coach.

American books of record—Continued.

ASSES.

Name of breed.	Book of record.	By whom published.
Jacks and jennets	American Jack Stock Studbook.	American Breeders' Association of Jacks and Jennets, J. W. Jones, secretary, Columbia, Tenn.

SHEEP.

Cheviot	American Cheviot Sheep Flock Book.	American Cheviot Sheep Society, F. E. Dawley, secretary, Fayetteville, N. Y.
Cotswold	American Cotswold Record.	American Cotswold Registry Association, F. W. Harding, secretary, Waukesha, Wis.
Dorset Horn	Continental Dorset Sheep Record.	The Continental Dorset Club, J. E. Wing, secretary, Mechanicsburg, Ohio.
Do	Flock Record of the Dorset Horn Sheep Breeders' Association of America.	Dorset Horn Sheep Breeders' Association of America, M. A. Cooper, secretary, Washington, Pa.
Hampshire Down	Hampshire Down Flock Record.	Hampshire Down Breeders' Association of America, Comfort A. Tyler, secretary, Nottawa, Mich.
Leicester	American Leicester Record.	American Leicester Breeders' Association, A. J. Temple, secretary, Cameron, Ill.
Lincoln	National Lincoln Sheep Breeders' Record.	National Lincoln Sheep Breeders' Association, Bert Smith, secretary, Charlotte, Mich.
Merino (Delaine)	Black Top Spanish Merino Sheep Register.	Black Top Spanish Merino Sheep Breeders' Publishing Association, R. P. Berry, secretary, Eightyfour, Pa.
Do	Dickinson Spanish Merino Sheep Register.	Dickinson Merino Sheep Record Company, H. G. McDowell, secretary, Canton, Ohio.
Do	Improved Delaine Merino Register.	Improved Delaine Merino Sheep Breeders' Association, George A. Henry, secretary, Bellefontaine, Ohio.
Do	National Delaine Merino Register.	National Delaine Merino Sheep Breeders' Association, J. B. Johnson, recording secretary-treasurer, Canonsburg, Pa.
Do	Standard Delaine Spanish Merino Sheep Breeders' Register.	Standard Delaine Spanish Merino Sheep Breeders' Association, S. M. Cleaver, secretary, West Brownsville, Pa.
Merino (French)	American Rambouillet Record.	American Rambouillet Sheep Breeders' Association, Dwight Lincoln, secretary, Milford Center, Ohio.
Merino (German)	International Von Homeyer Rambouillet Club Record.	International Von Homeyer Rambouillet Club, E. M. Moore, secretary, Orchard Lake, Mich.
Merino (Spanish)	Register of the Michigan Merino Sheep Breeders' Association.	Michigan Merino Sheep Breeders' Association, E. N. Ball, secretary, Hamburg, Mich.
Do	Register of the National Merino Sheep Breeders' Association.	National Merino Sheep Breeders' Association, R. O. Logan, secretary, Rural Free Delivery 3, Montgomery, Mich.
Do	Register of the New York State American Merino Sheep Breeders' Association.	New York State American Merino Sheep Breeders' Association, J. H. Earll, secretary, Skaneateles, N. Y.
Do	Register of the Ohio Spanish Merino Sheep Breeders' Association.	Ohio Spanish Merino Sheep Breeders' Association, Wesley Bishop, secretary, Rural Free Delivery 1, Delaware, Ohio.
Do	Register of the Standard American Merino Register Association.	Standard American Merino Register Association, J. P. Ray, secretary, Hemlock, N. Y.
Do	Register of the Vermont Merino Sheep Breeders' Association.	Vermont Merino Sheep Breeders' Association, C. A. Chapman, secretary and treasurer, Middlebury, Vt.
Oxford Down	American Oxford Record	American Oxford Down Record Association, W. A. Shafor, secretary, Hamilton, Ohio.
Shropshire	American Shropshire Sheep Record.	American Shropshire Registry Association, Mortimer Levering, secretary, Lafayette, Ind.
Southdown	American Southdown Record.	American Southdown Breeders' Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Suffolk	Register of the American Suffolk Flock Registry Association.	American Suffolk Flock Registry Association, George A. Franklin, secretary, Des Moines, Iowa.

American books of record—Continued.

HOGS.

Name of breed.	Book of record.	By whom published.
Berkshire	American Berkshire Record.	American Berkshire Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Cheshire	Cheshire Herdbook	Cheshire Swine Breeders' Association, Ed. S. Hill, secretary, Freeville, N. Y.
Chester White	American Chester White Record.	American Chester White Record Association, Ernest Freigau, secretary, Dayton, Ohio.
Do	Chester White Record	Chester White Record Association, W. H. Morris, secretary, 939-941 South Illinois street, Indianapolis, Ind.
Chester, Ohio, improved.	O. I. C. Record	O. I. C. Swine Breeders' Association, C. M. Hiles, secretary, Ajax Building, Cleveland, Ohio.
Duroc Jersey	American Duroc Jersey Record.	American Duroc Jersey Swine Breeders' Association, T. B. Pearson, secretary, Thorntown, Ind.
Do	National Duroc Jersey Record.	National Duroc Jersey Record Association, Robt. J. Evans, secretary, Elpaso, Ill.
Essex	American Essex Record	American Essex Association, F. M. Srout, secretary, McLean, Ill.
Hampshire (Thin Rind).	American Hampshire Record.	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.
Poland China	American Poland China Record.	American Poland China Record Company, W. M. McFadden, secretary, Union Stock Yards, Chicago, Ill.
Do	Central Poland China Record.	Central Poland China Record Association, W. H. Morris, secretary, 939-941 South Illinois street, Indianapolis, Ind.
Do	Ohio Poland China Record	Ohio Poland China Record Company, A. M. Brown, secretary, Dayton, Ohio.
Do	Southwestern Poland China Record.	Southwestern Poland China Record Association, H. P. Wilson, secretary, Gadsden, Tenn.
Do	Standard Poland China Record.	Standard Poland China Record Association, Geo. F. Woodworth, secretary, Maryville, Mo.
Tamworth	American Tamworth Swine Record.	American Tamworth Swine Record Association, E. N. Ball, secretary, Hamburg, Mich.
Victoria	Record of the Victoria Swine Breeders' Association.	Victoria Swine Breeders' Association, H. Davis, secretary, Dyer, Ind.
Yorkshire	American Yorkshire Record.	American Yorkshire Club, Harry G. Kurn, secretary and treasurer, Whitebear Lake, Minn.

DOGS.

Fifty-seven recognized breeds.	American Kennel Club Studbook.	American Kennel Club, A. P. Vredenburg, secretary, 55 Liberty street, New York, N. Y.

CATS.

Longhaired (Angora or Persian). Shorthaired (Siamese, Manx, Mexican, Abyssinian, Indian, Russian, and Japanese).	United States Register and Studbook (except appendix.)	United States Official Register Association (Incorporated), Mrs. S. Hazen Bond, secretary, 310 First street SE., Washington, D. C.
Longhaired (Persian or Angora). Shorthaired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, Native).	Studbook of the American Cat Association.	American Cat Association, Lucy C. Johnstone, secretary-treasurer, 5323 Madison avenue, Chicago, Ill.

Foreign books of record.

CATTLE.

Name of breed.	Book of record.	By whom published.
Aberdeen Angus	Polled Herdbook	Polled Cattle Society, Alex. Ramsay, secretary, 9 Old Market place, Banff, Scotland.
Ayrshire	Ayrshire Herdbook	Ayrshire Cattle Herdbook Society, John Howie, secretary, 58 Alloway street, Ayr, Scotland.
Brietenberger and Whilstermarsch.	Ostpreussisches Herdbuch für der Breitenberger und Whilstermarsch-Rasse.	Herdbuchgesellschaft für in Ostpreussen gezogenes rotbuntes Viehder Breitenburger und Whilstermarschrasse, Insterburg, Germany.
Brittany	Herdbook de la Race Bretonne Pie-Noire.	M. Chevalier, secretary.
Brown Swiss (Schwytz).[a]	Schweizerisches Heerdebuch.	Landwirthschaftlichen Verein, Schweiz.
Devon	Davy's Devon Herdbook	Devon Cattle Breeders' Society, John Risdon, jr., secretary, Wiveliscombe, Somerset, England.
Friesian[b]	Friesian Herdbook (Friesch Rundvee-Stamboek).	Friesch Rundvee-Stamboek, D. van Konijnenburg, secretary, Leeuwarden, Holland.
Galloway	Galloway Herdbook	Galloway Cattle Society, Rev. Jno. Gillespie, secretary, Mouswald Manse, Ruthwell, R. S. O., Dumfriesshire, Scotland.
Guernsey	English Guernsey Herdbook.	English Guernsey Cattle Society, E. H. Young, secretary, 12 Hanover square, London, W., England.
Do	Guernsey Herdbook	Royal Guernsey Agricultural Society, T. de Mouilipied, secretary, St. Peters Port, Island of Guernsey.
Hereford	Herdbook of Hereford Cattle.	Hereford Herdbook Society, W. E. Britten, secretary, 20 East street, Hereford, England.
Highland	Highland Herdbook	Highland Cattle Society of Scotland, Duncan Shaw, secretary, 42 High street, Inverness, Scotland.
Hollander	Baltisches Herdbook	Verband Pommerscher Züchter, Stettin, Germany.
Do	Ostpreussisches Herdbuch	Herdbuchgesellschaft zur Verbesserung des in Ostpreussen gezüchteten Holländer Rindviehes, Königsberg, Germany.
Do	Westpreussisches Herdbuch.	Westpreussische Herdbuchgesellschaft, Danzig, Germany.
Holstein Elbmarsch.	Herdbuch des Viehzucht-Vereins für die Holsteinische Elbmarsch.	Viehzuchtverein f. d. Holsteinische Elbmarsch, Obendeich, Germany.
Jersey	English Jersey Herdbook	English Jersey Cattle Society, John Thornton, secretary, 7 Princes street, Hanover square, London, W., England.
Do	Jersey Herdbook	Royal Jersey Agricultural Society, John A. Perree, secretary, 8 Church street, St. Helier, Island of Jersey.
Jeverland	Herdbuch für die Marschen des Jeverland.	Jeverlander Herdbuchverein, Hohenkirchen, Germany.
Kerry and Dexter Kerry.	Kerry and Dexter Herdbook.	Kerry and Dexter Cattle Society, F. A. Hordern, secretary, 12 Hanover square, London, W., England.
Norman	Herdbook de la Race Normande Pure.	M. Delahoguette, secretary-treasurer, Calvados, France.
North Holland[c]	North Holland Herdbook (Rundvee-Stamboek "Noord Holland").	Vereeniging het Rundvee-Stamboek "Noord Holland," D. Laan, secretary-treasurer, Schellinkhout, Holland.
Oldenburg	Herdbuch für die Oldenburghischer Wesermarschen.	Oldenburger Wesermarsche Herdbuchverein, Oberhammelwarden, Germany.
Ostfriesischer	Stammbuch Ostfriesischer Rindviehschläge.	Verein Ostfriesischer Stammviehzüchter, Norden, Germany.
Red Polled	Red Polled Herdbook	Red Polled Society of Great Britain and Ireland, Albert D. Euren, secretary, Mercury office, Norwich, Norfolk, England.
Shorthorn	Coates's Herdbook	Shorthorn Society of Great Britain and Ireland, E. J. Powell, secretary, 12 Hanover square, London, W., England.
Do	Le Herdbook Français pour les animaux de la Race Bovine de Durham.	
Do	New Zealand Shorthorn Herdbook.	Canterbury Agricultural and Pastoral Association, editor, box 205, Christchurch, New Zealand.
Simmenthal (Berner Fleckvieh).[a]	Schweizerisches Heerdbuch	Landwirthschaftlichen Verein, Schweiz.

[a] Withdrawn. See amendment No. 1, page 602. [b] See North Holland. [c] See Friesian.

Foreign books of record—Continued.

CATTLE—Continued.

Name of breed.	Book of record.	By whom published.
South Devon or Hams.	South Devon Herdbook	South Devon Herdbook Society, Alfred Michelmore, secretary, Gate House, Totnes, Devon, England.
Sussex	Sussex Herdbook	Sussex Herdbook Society, W. C. Young, secretary, 12 Hanover square, London, W., England.
Welsh	North Wales Black Cattle Book.	North Wales Black Cattle Society, William Arthur Dew, secretary, Wellfield, Bangor, North Wales.
Do	Welsh Black Cattle Herdbook.	R. H. Harvey, editor, Slade Hall, Haverfordwest, South Wales.

HORSES.

Name of breed.	Book of record.	By whom published.
Barb	Le Studbook Algerien	
Belgian Draft	Studbook des Chevaux de Trait Belges.	Société Le Cheval de Trait Belge, Chevalier G. Hynderick, secretary, Brussels, Belgium.
Boulonnaise[a]	Studbook des Chevaux de Trait Français.	Société des Agriculteurs de France, M. Henri Johanet, secretary, 8 Rue d'Athènes, Paris, France.
Cleveland Bay	Cleveland Bay Studbook	Cleveland Bay Horse Society of Great Britain and Ireland, Wm. Scarth Dixon, secretary, Saltburn by the Sea, York, England.
Clydesdale	Clydesdale Studbook	Clydesdale Horse Society of the United Kingdom of Great Britain and Ireland, Arch'd MacNeilage, secretary, 93 Hope street, Glasgow, Scotland.
East Friesland Coach.	Ostfriesisches Stutbuch	Landwirthschaftlichen Hauptverein für Ostfriesland.
French Coach	Le Studbook Français. Registre des Chevaux de Demi-Sang.	Commission des Studbook des Chevaux de Demi-Sang, Directeur-Général des Haras, Ministére de l'Agriculture, Paris, France.
French Draft[b]	Studbook des Chevaux de Trait Français.	Société des Agriculteurs de France, M. Henri Johanet, secretary, 8 Rue d'Athènes, Paris, France.
Hackney	Hackney Studbook	Hackney Horse Society, Frank F. Euren, secretary, 12 Hanover square, London, W., England.
Hanoverian	Hanoverian Studbook	Hannöverisches Stutbuch für edles Halbblut, Celle, Germany.
Holstein Coach	Gestütbuch der Holsteinischen Marschen.	Verband der Pferdezuchtvereine in den Holsteinischen Marschen, Martin Thormählen, secretary, Moorhusen per Elmshorn, Holstein, Germany.
Oldenburg Coach	Oldenburger Stutbuch	Verband der Züchter des Oldenburger eleganten schweren Kutschpferdes, Justus Schüssler, secretary-treasurer, Rodenkirchen, Oldenburg, Germany.
Do	Stutbuch der Münsterländisch-Oldenburgischen Geest.	Zuchtverband des südlichen Zuchtgebietes.
Orloff	Record of the Imperial Russian Horse Breeding Society.	
Percheron	Studbook Percheron de France.	La Société Hippique Percheronne de France, M. Raoul Boullay, secretary, Nogent-le-Rotrou, France.
Select Clydesdale	Studbook of the Select Clydesdale Horse Society of Scotland.	Select Clydesdale Horse Society of Scotland, Thomas W. Sloan, secretary, 49 West George street, Glasgow, Scotland.
Shire	Shire Horse Studbook	Shire Horse Society, J. Sloughgrove, secretary, 12 Hanover square, London, W., England.
Shetland Pony	Shetland Pony Studbook	Shetland Pony Studbook Society, Robert R. Ross, secretary, Balmoral Buildings, Aberdeen, Scotland.
Suffolk	Suffolk Studbook	Suffolk Horse Society, Fred Smith, secretary, Rendlesham, Woodbridge, Suffolk, England.
Trakehnen	Ostpreussisches Stutbuch	Landwirthschaftlichen Central-Verein für Litauen und Masuren, C. M. Stoeckel, secretary, Insterburg, East Prussia.
Do	Stutbuch von Trakehnen	Königlich Preussischen Gestüt-Verwaltung, Landwirthschaftlichen Central-Verein für Litauen und Masuren, C. M. Stoeckel, secretary, Insterburg, East Prussia.

[a] See French Draft.

[b] See Boulonnaise.

Foreign books of record—Continued.

HORSES—Continued.

Name of breed.	Book of record.	By whom published.
Thoroughbred	Australian Studbook	W. C. Yuille & Sons, Melbourne, Australia.
Do	General Studbook	Weatherby & Sons, 6 Old Burlington street, London, W., England.
Do	Studbook Français	
Yorkshire Coach	Yorkshire Coach Horse Studbook.	Yorkshire Coach Horse Society of Great Britain and Ireland, John White, secretary, The Grange, Appleton, Roebuck, Bolton Percy, R. S. O., England.

ASSES.

Jacks and jennets	Studbook des Animaux de l'espèce mulassière.	Société Centrale d'Agriculture des Deux-Sevres, G. Disleau, secretary, Niort, France.
Do	Studbook of Jacks and Jennets of Spain.	

SHEEP.

Cheviot	Cheviot Sheep Flock Book	Cheviot Sheep Society, Jno. Robson, secretary, Newton, Bellingham, Northumberland, England.
Cotswold	Cotswold Flock Book	Cotswold Sheep Society, James W. Tayler, secretary, Cold Ashton, Cheltenham, England.
Dorset Horn	Dorset Flock Book	Dorset Horn Sheep Breeders' Association, Thos. H. Ensor, secretary, 54 South street, Dorchester, Dorset, England.
Hampshire Down	Hampshire Down Flock Book.	Hampshire Down Sheep Breeders' Association, James E. Rawlence, secretary, 49 The Canal, Salisbury, England.
Kent, or Romney Marsh.	Kent, or Romney Marsh Flock Book.	Kent Sheep Breeders' Association, W. W. Chapman, secretary, Room 32, Fitzalan House, Arundel street, Strand, London, W. C., England.
Leicester	Leicester Flock Book	Leicester Sheep Breeders' Association, W. A. Brown, secretary, Elms Villa, Great Driffield, East Yorkshire, England.
Lincoln	Lincoln Longwool Sheep Flock Book.	Lincoln Longwool Sheep Breeders' Association, Stephen Upton, secretary. St. Benedict square, Lincoln, England.
Oxford Down	Oxford Down Flock Book	Oxford Down Sheep Breeders' Association, A. F. Milton Druce, secretary, 11 Queen street, Oxford, England.
Shropshire	Shropshire Flock Book	Shropshire Sheep Breeders' Association and Flock Book Society, Alfred Mansell & Co., secretaries, College Hill, Shrewsbury, England.
Southdown	Southdown Flock Book	Southdown Sheep Society, W. J. Wickison, secretary, 12 Hanover square, London, W., England.
Suffolk	Suffolk Flock Book	Suffolk Sheep Society, Ernest Prentice, secretary, 64 Oxford street, Ipswich, England.
Wensleydale	Wensleydale Bluefaced Sheep Flock Book.	Incorporated Wensleydale Bluefaced Sheep Breeders' Association and Flock Book Society, Wm. Rhodes, secretary, Lundholme, Westhouse, near Kirby, Lonsdale, England.
Do	Wensleydale Flock Book	Wensleydale Longwool Sheep Breeders' Association and Flock Book Society, T. F. King, secretary, Edgley, Leyburn, Yorkshire, England.

Foreign books of record—Continued.

HOGS.

Name of breed.	Book of record.	By whom published.
Berkshire	British Berkshire Herdbook.	British Berkshire Society, Herber Humfrey, secretary, Shippen, Abingdon, Berks, England.
Small black (Suffolk or Essex). Large White (Large Yorkshire). Middle White (Middle Yorkshire). Small White (Small Yorkshire). Tamworth. Berkshire	Herdbook of the National Pig Breeders' Association.	National Pig Breeders' Association, John Parr, secretary, Ruddington, Nottingham, England.

DOGS.

Fifty-seven recognized breeds.	Kennel Club Studbook	E. W. Jaquet, secretary, 7 Grafton street, Bond street, London, W., England.
Fox Hound	Fox Hound Kennel Studbook.	Masters of Fox Hounds' Association, Cecil Legard, editor, Cottesbrooke Rectory, Northampton, England.
Greyhound	Greyhound Studbook	National Coursing Club, W. F. Lamonby, keeper of the Greyhound Studbook, Windsor House, Bream's Buildings, London, E. C., England.
St. Bernard and others.	Schweizerisches Hunde-Stammbuch.	Schweizerische Kynologische Gesellschaft, Max Siber, président, Winterthur, Switzerland.

JAMES WILSON, *Secretary.*

(AMENDMENT NO. 1 TO B. A. I. ORDER NO. 130.)

Regulations for the Certification of Associations of Breeders of Pure-Bred Live Stock and Books of Record of Pedigrees—Withdrawal of the Certification of the Schweizerisches Heerdebuch.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 24, 1904.

The Department having been informed through the Secretary of State that the Schweizerisches Heerdebuch no longer exists in Switzerland, the withdrawal of the certification of this book of record has this day been recommended to the Secretary of the Treasury.

WILLIS L. MOORE, *Acting Secretary.*

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